# SU-Series 3-Phase UPS Hardware: Introduction and Troubleshooting

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# 1 Basic Operation

## 1.1 Technical Specifications

**KX Models:**

| **Model (Capacity)** | | | **SU20KX (20kVA/16kW)** | **SU40KX (40kVA/32kW)** | **SU60KX (60kVA/48kW)** | **SU80KX (80kVA/64kW)** |
|---|---|---|---|---|---|---|
| Input | Input Voltage | | 220/380V, 230/400V or 240/415V AC, 3Ø, 4-wire + ground, wye | | | |
| | Voltage Regulation | | -25% ~ +20% | | | |
| | Harmonic Distortion | | < 5% (Full Load) | | | |
| | PFC (Full Load) | | > 0.99 | | | |
| | Frequency | | 50 / 60 Hz | | | |
| | Frequency Tolerance | | 45 ~ 65 Hz | | | |
| Output | Output Voltage | | 220/380V, 230/400V or 240/415V AC, 3Ø, 4-wire + ground, wye | | | |
| | Output Frequency | | 50 / 60 Hz | | | |
| | Total Harmonic (Linear Load) | | ≤3% | | | |
| | Voltage Regulation | Static | ±1% | | | |
| | Frequency Regulation | Dynamic | ±7% (10% ~ 90% Linear Load) | | | |
| | | Interior Oscillator | ±0.05 Hz | | | |
| | | Synchronized | ±5% | | | |
| | Overload | | ≤125% : 10 minutes; ≤150% : 1 minute | | | |
| Audible Warning | Battery Backup | | Intermittent | | | |
| | UPS Abnormal | | Continuous | | | |
| Display | LED | | UPS Status: Normal • Bypass • Backup • Fault | | | |
| | LCD | | Input/Output • Bypass • Inverter • Frequency • Loading • Battery Voltage UPS abnormal messages with intelligent self-diagnosis. | | | |
| Interface | Standard | | RS-232, Dry Contact | | | |
| | Optional | | SNMPWEBCARD | | | |
| Others | Parallel Redundancy | | Yes (1+1 for 2 UPS systems of the same type and capacity only.) | | | |
| | EPO | | Standard (Local and Remote) | | | |
| | SRAM Event Log | | 500 Records | | | |
| | Parameter Configuration | | Yes | | | |
| | Hot Standby Installation | | Optional | | | |
| | Battery Temperature Compensation | | Optional | | | |
| | Battery Cold-Start | | Standard | | | |
| Overall | Efficiency | Normal | 94% | | | |
| | | ECO | 97% | | | |
| | Transfer Time | | 0 ms | | | |
| | Temperature | | 32° F ~ 104° F (0° C ~ 40° C) | | | |
| | Humidity (non-condensing) | | 90% | | | |
| | Noise (1 m) | | 65 dBA | 68 dBA | 70 dBA | 70 dBA |
| | Dimensions (Power Module) | Width | 520 mm | | | |
| | | Depth | 850 mm | | | |
| | | Height | 1165 mm | | | |
| | Weight (Power Module) | | 267 kg* | 412 kg* | 210 kg | 244 kg |

## 1.1 Technical Specifications *(continued)*

**K and KTV Models:**

| **Model (Capacity)** | | | **SU40K (40kVA/32kW)** | **SU60K (60kVA/48kW)** | **SU60KTV (60kVA/48kW)** | **SU80KTV (80kVA/64kW)** |
|---|---|---|---|---|---|---|
| Input | Input Voltage | | 120/208V AC, 3Ø, 4-wire + ground, wye | | 277/480V AC, 3Ø, 4-wire + ground, wye | |
| | Voltage Regulation | | -25% ~ +20% | | | |
| | Harmonic Distortion | | < 5% (Full Load) | | | |
| | PFC (Full Load) | | > 0.99 | | | |
| | Frequency | | 50 / 60 Hz | | | |
| | Frequency Tolerance | | 45 ~ 65 Hz | | | |
| Output | Output Voltage | | 120/208V AC, 3Ø, 4-wire + ground, wye | | 277/480V AC, 3Ø, 4-wire + ground, wye | |
| | Output Frequency | | 50 / 60 Hz | | | |
| | Total Harmonic (Linear Load) | | ≤3% | | | |
| | Voltage Regulation | Static | ±1% | | | |
| | Frequency Regulation | Dynamic | ±7% (10% ~ 90% Linear Load) | | | |
| | | Interior Oscillator | ±0.05 Hz | | | |
| | | Synchronized | ±5% | | | |
| | Overload | | ≤125% : 10 minutes; ≤150% : 1 minute | | | |
| Audible Warning | Battery Backup | | Intermittent | | | |
| | UPS Abnormal | | Continuous | | | |
| Display | LED | | UPS Status: Normal • Bypass • Backup • Fault | | | |
| | LCD | | Input/Output • Bypass • Inverter • Frequency • Loading • Battery Voltage<br>UPS abnormal messages with intelligent self-diagnosis. | | | |
| Interface | Standard | | RS-232, Dry Contact | | | |
| | Optional | | SNMPWEBCARD | | | |
| Others | Parallel Redundancy | | Yes (1+1 for 2 UPS systems of the same type and capacity only.) | | | |
| | EPO | | Standard (Local and Remote) | | | |
| | SRAM Event Log | | 500 Records | | | |
| | Parameter Configuration | | Yes | | | |
| | Hot Standby Installation | | Optional | | | |
| | Battery Temperature Compensation | | Optional | | | |
| | Battery Cold-Start | | Standard | | | |
| Overall | Efficiency | Normal | 92% | | | |
| | | ECO | 96% | | | |
| | Transfer Time | | 0 ms | | | |
| | Temperature | | 32° F ~ 104° F (0° C ~ 40° C) | | | |
| | Humidity (non-condensing) | | 90% | | | |
| | Noise (1 m) | | 65 dBA | 68 dBA | 70 dBA | 70 dBA |
| | Dimensions (Power Module) | Width | 520 mm | | | |
| | | Depth | 850 mm | 950 mm | 850 mm | |
| | | Height | 1696 mm | | | |
| | Weight (Power Module) | | 682 kg* | 534 kg | 534 kg | 584 kg |

* With internal batteries.

## 1.1 Technical Specifications *(continued)*

**SU80K Model:**

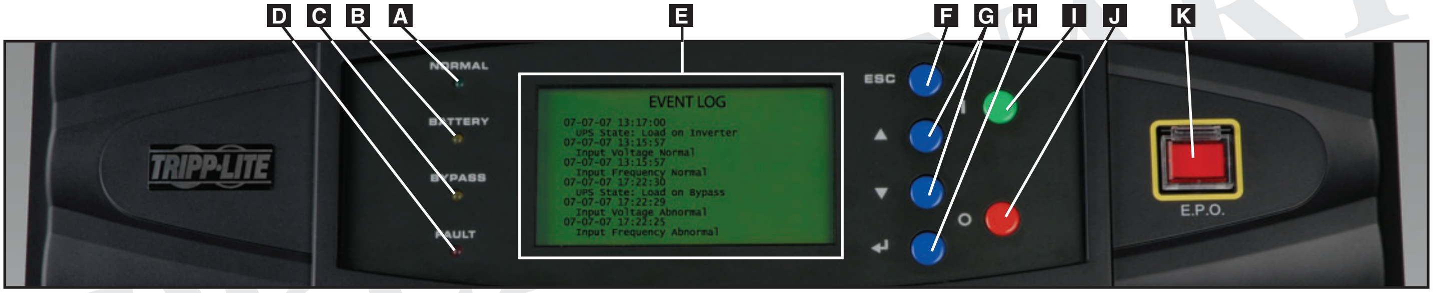
| Model (Capacity) | | | **SU80K (80kVA/64kW)** |
|---|---|---|---|
| Input | Input Voltage | | 120/208V AC, 3Ø, 4-wire + ground, wye |
| | Voltage Regulation | | -25% ~ +20% |
| | Harmonic Distortion | | < 5% (Full Load) |
| | PFC (Full Load) | | > 0.99 |
| | Frequency | | 50 / 60 Hz |
| | Frequency Tolerance | | 45 ~ 65 Hz |
| Output | Output Voltage | | 120/208V AC, 3Ø, 4-wire + ground, wye |
| | Output Frequency | | 50 / 60 Hz |
| | Total Harmonic (Linear Load) | | ≤3% |
| | Voltage Regulation | Static | ±1% |
| | | Dynamic | ±7% (10% ~ 90% Linear Load) |
| | Frequency Regulation | Interior Oscillator | ±0.05 Hz |
| | | Synchronized | ±5% |
| | Overload | | ≤125% : 10 minutes; ≤150% : 1 minute |
| Audible Warning | Battery Backup | | Intermittent |
| | UPS Abnormal | | Continuous |
| Display | LED | | UPS Status: Normal • Bypass • Backup • Fault |
| | LCD | | Input/Output • Bypass • Inverter • Frequency • Loading • Battery Voltage UPS abnormal messages with intelligent self-diagnosis. |
| Interface | Standard | | RS-232, Dry Contact |
| | Optional | | SNMPWEBCARD |
| Others | Parallel Redundancy | | Yes (1+1 for 2 UPS systems of the same type and capacity only.) |
| | EPO | | Standard (Local and Remote) |
| | SRAM Event Log | | 500 Records |
| | Parameter Configuration | | Yes |
| | Hot Standby Installation | | Optional |
| | Battery Temperature Compensation | | Optional |
| | Battery Cold-Start | | Standard |
| Overall | Efficiency | Normal | 92% |
| | | ECO | 96% |
| | Transfer Time | | 0 ms |
| | Temperature | | 32° F ~ 104° F (0° C ~ 40° C) |
| | Humidity (non-condensing) | | 90% |
| | Noise (1 m) | | 70 dBA |
| | Dimensions (Power Module) | Width | 520 mm |
| | | Depth | 1026 mm |
| | | Height | 1696 mm |
| | Weight (Power Module) | | 655 kg |

## 1.2 Features

### 1.2.1 Advanced Features:

- True on-line double conversion with superior IGBT inverter technology
- Low input current THD allows 1:1 generator sizing for maximum efficiency and cost savings
- Internal N+1 power module redundancy (except for SU20KX model)
- Built-in parallel redundancy (1+1) capability for increased capacity or fault-tolerance
- Up to 80kVA capacity in a compact footprint; up to 160kVA in parallel redundancy (1+1) configuration
- High input power factor and high efficiency with low thermal loss and low noise
- Simplified, easy-to-repair, long-life, high-availability system design
- Redundant auxiliary power and control circuits
- Dual input design with separated rectifier and bypass input (SU20K, SU40K, SU60K, SU80K only)
- All models support external battery cabinets for extended battery backup runtime
- High-resolution LCD status screen simplifies operation and delivers detailed operational information, including system block diagrams

### 1.2.2 Control Panel Features



```
EVENT LOG
07-07-07 13:17:00
  UPS State: Load on Inverter
07-07-07 13:15:57
  Input Voltage Normal
07-07-07 13:15:57
  Input Frequency Normal
07-07-07 17:22:30
  UPS State: Load on Bypass
07-07-07 17:22:29
  Input Voltage Abnormal
07-07-07 17:22:25
  Input Frequency Abnormal
```

**A** **"NORMAL" LED:** This green light illuminates to indicate that the UPS system is in online (normal) mode. The primary AC input supply is present and within standard operating parameters.

**B** **"BATTERY" LED:** This amber light illuminates when the UPS system is in battery backup mode, discharging the batteries to provide power to connected equipment. An audible alarm will also sound.

**C** **"BYPASS" LED:** This amber light illuminates when the UPS system is in bypass mode (auto bypass or manual bypass). Battery backup power will not be available to connected equipment while the UPS system is in bypass mode, but connected equipment loads will be supported by the bypass (reserve) power source.

**D** **"FAULT" LED:** This red light illuminates when any UPS system or input power fault occurs. Available diagnostic information will be displayed on the LCD screen.

**E** **LCD Status Screen:** This illuminated LCD status screen displays text and graphics to indicate a wide range of UPS system operating conditions and diagnostic data. *Note: The LCD backlight will turn off after 10 minutes of inactivity. Turn on the backlight by momentarily pressing the ON button or one of the scroll buttons.*

**F** **"ESC" (Escape) Button:** Press this button to return to the previous page or menu.

**G** **Scroll Buttons (▲ and ▼):** Press these buttons to move the cursor up or down and navigate the control panel menus and screens. These buttons are also used for data entry in several screens.

**H** **Enter Button (↵):** Press this button to select a menu item or confirm a setting change.

**I** **ON Button:** Press and hold this button for 3 seconds to turn the UPS system's inverter ON.

**J** **OFF Button:** Press and hold this button for 3 seconds to turn the UPS system's inverter OFF. If the UPS system is in online (normal) mode, it will switch to auto bypass mode. *Note: If the UPS system remains off for an extended period of time, the batteries should be recharged periodically. The UPS system should be turned on and the batteries should be recharged at least one uninterrupted 24-hour period every 3 months. Failure to recharge the batteries periodically may cause irreversible battery damage.*

**K** **"EPO" (Emergency Power Off) Button:** Press this button to turn the UPS system's output OFF and also disable bypass output.

If the UPS system is in battery backup mode when the EPO button is activated:

- Main output and bypass output are turned off, the alarm sounds, fans shut down after approximately one minute, and control circuitry remains active.
- Releasing the EPO button (by pressing it again) turns off the UPS system completely, including the alarm and control circuit. Press the ON button for 3 seconds to restart the UPS system.

If the UPS system is in online (normal) mode when the EPO button is activated:

- Main output and bypass output are turned off, the alarm sounds, fans and control circuitry remain active.
- Releasing the EPO button (by pressing it again) turns off the alarm and places the UPS system in auto bypass mode. Press the ON button for 3 seconds to return the UPS system to online (normal) mode.

## 1.2 Features *(continued)*

### 1.2.3 Front and Rear Panel Features

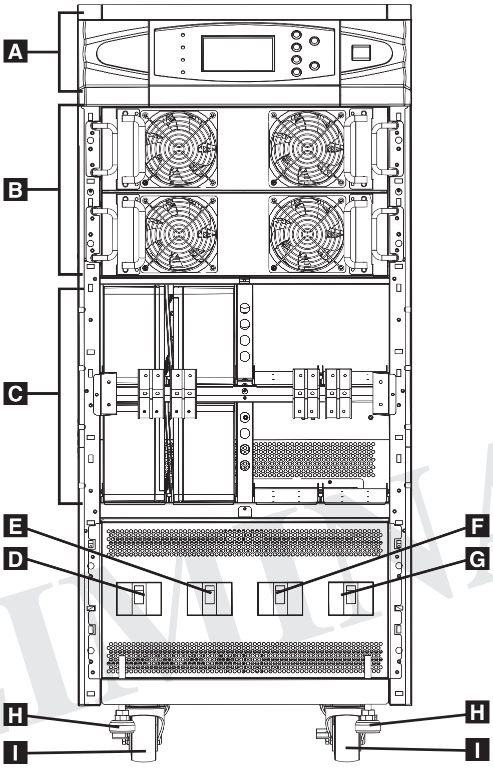


*Fig 1.2.3a SU40KX front*

***Note:*** *Individual models may vary from diagrams. Unit shown with front bezels removed.*

**A** **Control Panel:** The control panel allows the operator to monitor and control the UPS system. (See section 1.2.2 for more information.)

**B** **Internal Power Modules:** 20kVA internal power modules can be replaced in the field without powering down connected equipment loads. The number of internal power modules varies by model. The internal power modules are capable of N+1 redundancy in SU40KX, SU60KX and SU80KX models.

**C** **Internal Battery Pack Compartment (SU20KX and SU40KX only; shown without batteries):** Internal batteries must be connected by a qualified electrician. (See section 4 for more information.)

**D** **Output Circuit Breaker Switch (Q4):** Controls AC output power.

**E** **Manual Bypass Circuit Breaker Switch (Q3):** Controls AC input power to the UPS system during manual bypass operation.

**F** **Bypass Input Circuit Breaker Switch (Q2):** Controls AC input power to the UPS system during auto bypass operation.

**G** **Main Input Circuit Breaker Switch (Q1):** Controls AC input power to the UPS system during online (normal) operation.

**H** **Levelers:** The levelers provide long-term support for the UPS system.

**I** **Casters:** The casters are designed for small position adjustments within the final installation location only; they are not designed for moving the UPS system over longer distances. The casters are not designed to provide long-term support for the UPS system after final installation. Use the levelers to provide long-term support.

## 1.2 Features *(continued)*

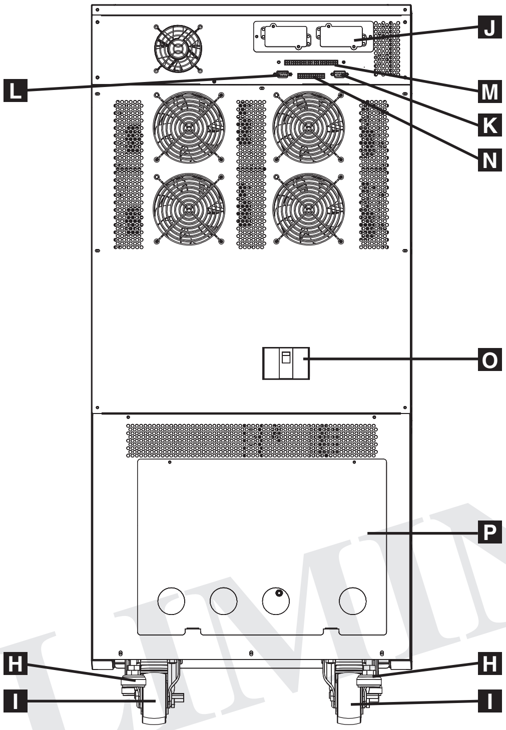


*Fig 1.2.3b SU40KX rear*

***Note:*** *Individual models may vary from diagrams. Unit shown with front bezels removed.*

**H** **Levelers:** The levelers provide long-term support for the UPS system.

**I** **Casters:** The casters are designed for small position adjustments within the final installation location only; they are not designed for moving the UPS system over longer distances. The casters are not designed to provide long-term support for the UPS system after final installation. Use the levelers to provide long-term support.

**J** **Accessory Slot:** Remove the cover panel to install a Tripp Lite SNMPWEBCARD accessory. The SNMPWEBCARD accessory provides an Ethernet interface for the UPS system and enables remote monitoring and control via SNMP, Web browser or telnet. Call +1 773 869 1234 for more information about the SNMPWEBCARD accessory.

**K** **RS-232 Serial Communications Port:** This DB9 port connects the UPS system to compatible workstations or servers, enabling automatic shutdown during extended blackouts and monitoring of operating and power conditions.

**L** **Parallel Redundancy Port:** This DB9 port connects the UPS system to another UPS system of identical type and capacity for use in a parallel redundancy (1+1) configuration. (See sections 1.5 and 1.8 for more information.)

**M** **Input Dry Contact Interface:** This interface receives dry contact signals that allow the UPS system to receive commands and monitor external battery conditions.

**N** **Output Dry Contact Interface:** This interface allows the UPS system to send information via dry contact communications. (See section 3.3 for more information.)

**O** **Internal Battery Circuit Breaker Switch (SU20KX and SU40KX only):** Controls the input/output power of the UPS system's internal batteries.

**P** **Terminal Block Cover:** Remove the terminal block cover to access the UPS system's input, bypass input, external battery cabinet, output and grounding connection terminals. Wiring conduits pass through the circular knockouts in the terminal block cover. (See section 1.8 for more information, including a detailed diagram of the terminal block.)

## 1.2 Features *(continued)*

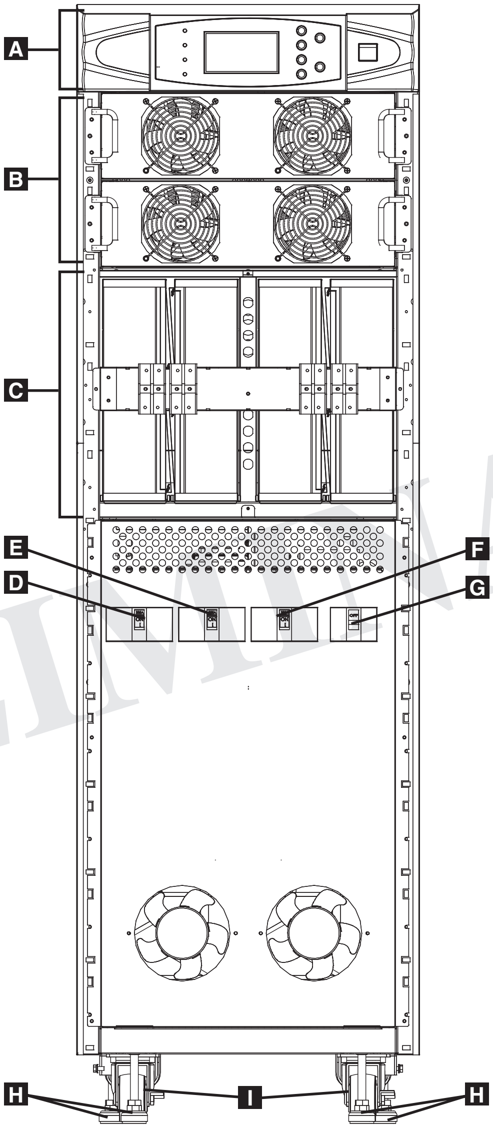


*Fig 1.2.3c SU40K front*

***Note:*** *Individual models may vary from diagrams. Unit shown with front bezels removed.*

**A** **Control Panel:** The control panel allows the operator to monitor and control the UPS system. (See section 1.2.2 for more information.)

**B** **Internal Power Modules:** 20kVA internal power modules can be replaced in the field without powering down connected equipment loads. The number of internal power modules varies by model. The internal power modules are capable of N+1 redundancy.

**C** **Internal Battery Pack Compartment (SU40K only):** Internal batteries must be connected by a qualified electrician. (See section 4 for more information.)

**D** **Output Circuit Breaker Switch (Q4):** Controls AC output power.

**E** **Manual Bypass Circuit Breaker Switch (Q3):** Controls AC input power to the UPS system during manual bypass operation.

**F** **Bypass Input Circuit Breaker Switch (Q2):** Controls AC input power to the UPS system during auto bypass operation.

**G** **Main Input Circuit Breaker Switch (Q1):** Controls AC input power to the UPS system during online (normal) operation.

**H** **Levelers:** The levelers provide long-term support for the UPS system.

**I** **Casters:** The casters are designed for small position adjustments within the final installation location only; they are not designed for moving the UPS system over longer distances. The casters are not designed to provide long-term support for the UPS system after final installation. Use the levelers to provide long-term support.

## 1.2 Features *(continued)*

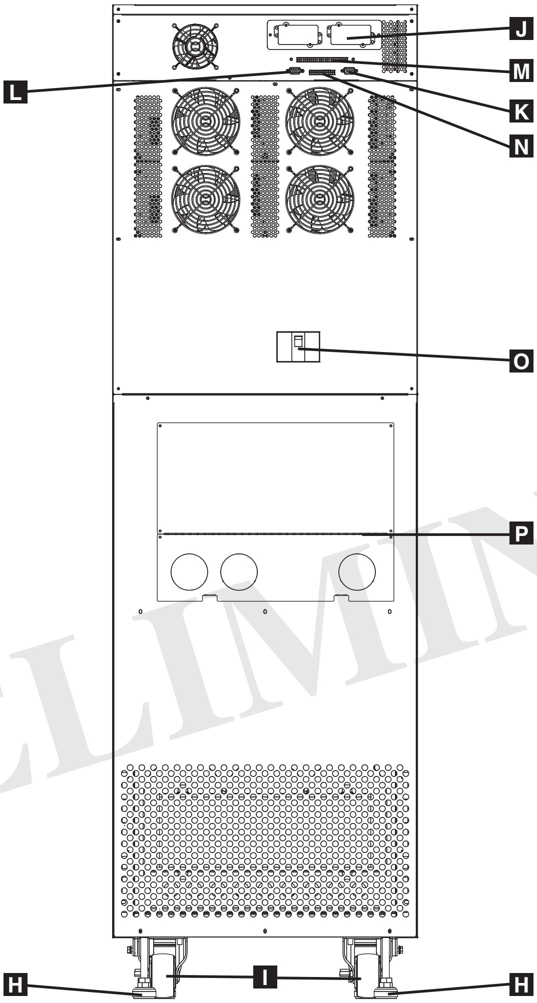


*Fig 1.2.3d SU40K rear*

***Note:** Individual models may vary from diagrams. Unit shown with front bezels removed.*

**H** **Levelers:** The levelers provide long-term support for the UPS system.

**I** **Casters:** The casters are designed for small position adjustments within the final installation location only; they are not designed for moving the UPS system over longer distances. The casters are not designed to provide long-term support for the UPS system after final installation. Use the levelers to provide long-term support.

**J** **Accessory Slot:** Remove the cover panel to install a Tripp Lite SNMPWEBCARD accessory. The SNMPWEBCARD accessory provides an Ethernet interface for the UPS system and enables remote monitoring and control via SNMP, Web browser or telnet. Call (773) 869-1234 for more information about the SNMPWEBCARD accessory.

**K** **RS-232 Serial Communications Port:** This DB9 port connects the UPS system to compatible workstations or servers, enabling automatic shutdown during extended blackouts and monitoring of operating and power conditions.

**L** **Parallel Redundancy Port:** This DB9 port connects the UPS system to another UPS system of identical type and capacity for use in a parallel redundancy (1+1) configuration. (See sections 1.5 and 1.8 for more information.)

**M** **Input Dry Contact Interface:** This interface receives dry contact signals that allow the UPS system to receive commands and monitor external battery conditions.

**N** **Output Dry Contact Interface:** This interface allows the UPS system to send information via dry contact communications. (See section 3.3 for more information.)

**O** **Internal Battery Circuit Breaker Switch (SU40K only):** Controls the input/output power of the UPS system's internal batteries.

**P** **Terminal Block Cover:** Remove the terminal block cover to access the UPS system's input, external battery cabinet, output and grounding connection terminals. Wiring conduits pass through the circular knockouts in the terminal block cover. (See section 1.8 for more information, including a detailed diagram of the terminal block.)

## 1.2 Features *(continued)*

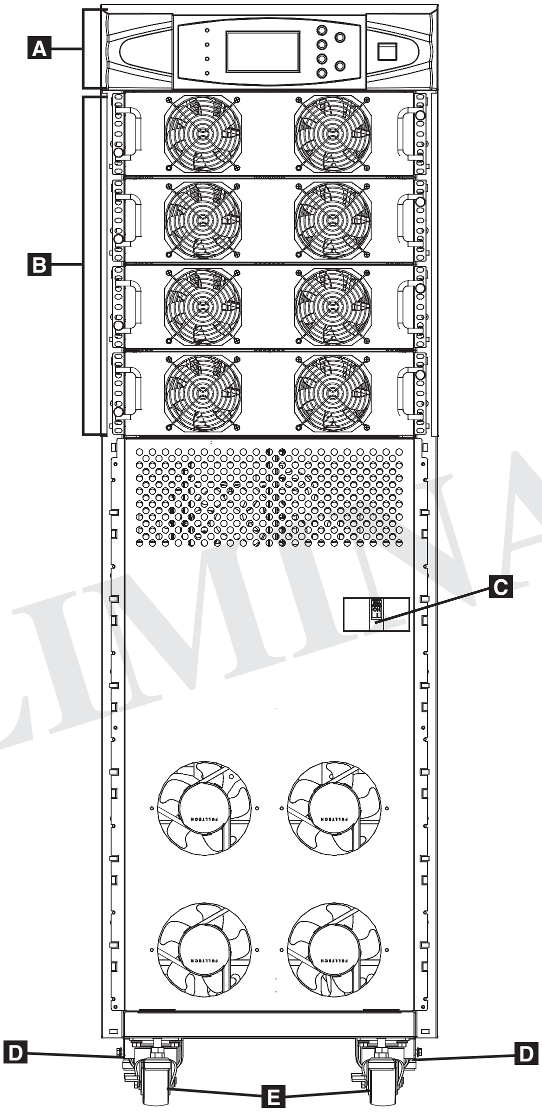


*Fig 1.2.3e SU80K front*

***Note:*** *Individual models may vary from diagrams. Unit shown with front bezels removed.*

**A** **Control Panel:** The control panel allows the operator to monitor and control the UPS system. (See section 1.2.2 for more information.)

**B** **Internal Power Modules:** 20kVA internal power modules can be replaced in the field without powering down connected equipment loads. The number of internal power modules varies by model. The internal power modules are capable of N+1 redundancy.

**C** **Main Input Circuit Breaker Switch (Q1):** Controls AC input power to the UPS system during online (normal) operation.

**D** **Levelers:** The levelers provide long-term support for the UPS system.

**E** **Casters:** The casters are designed for small position adjustments within the final installation location only; they are not designed for moving the UPS system over longer distances. The casters are not designed to provide long-term support for the UPS system after final installation. Use the levelers to provide long-term support.

## 1.2 Features *(continued)*

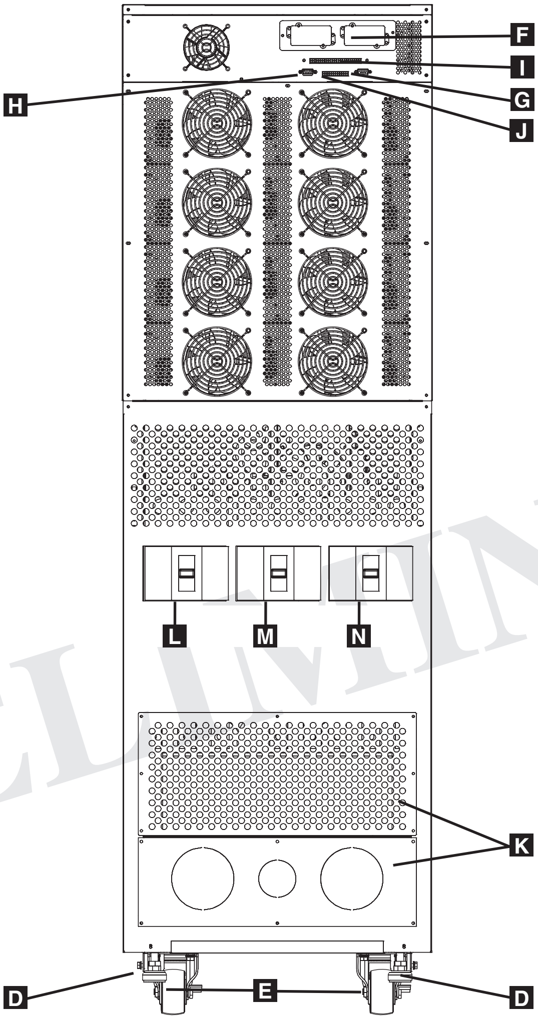


*Fig 1.2.3f SU80K rear*

***Note:*** *Individual models may vary from diagrams. Unit shown with breaker guard removed.*

**D** **Levelers:** The levelers provide long-term support for the UPS system.

**E** **Casters:** The casters are designed for small position adjustments within the final installation location only; they are not designed for moving the UPS system over longer distances. The casters are not designed to provide long-term support for the UPS system after final installation. Use the levelers to provide long-term support.

**F** **Accessory Slot:** Remove the cover panel to install a Tripp Lite SNMPWEBCARD accessory. The SNMPWEBCARD accessory provides an Ethernet interface for the UPS system and enables remote monitoring and control via SNMP, Web browser or telnet. Call (773) 869-1234 for more information about the SNMPWEBCARD accessory.

**G** **RS-232 Serial Communications Port:** This DB9 port connects the UPS system to compatible workstations or servers, enabling automatic shutdown during extended blackouts and monitoring of operating and power conditions.

**H** **Parallel Redundancy Port:** This DB9 port connects the UPS system to another UPS system of identical type and capacity for use in a parallel redundancy (1+1) configuration. (See sections 1.5 and 1.8 for more information.)

**I** **Input Dry Contact Interface:** This interface receives dry contact signals that allow the UPS system to receive commands and monitor external battery conditions.

**J** **Output Dry Contact Interface:** This interface allows the UPS system to send information via dry contact communications. (See section 3.3 for more information.)

**K** **Terminal Block Cover:** Remove the terminal block cover to access the UPS system's input, external battery cabinet, output and grounding connection terminals. Wiring conduits pass through the circular knockouts in the terminal block cover. The UPS system includes alternate circular knockouts in the bottom panel. (See section 1.8 for more information, including a detailed diagram of the terminal block.)

**L** **Bypass Input Circuit Breaker Switch (Q2):** Controls AC input power to the UPS system during auto bypass operation.

**M** **Manual Bypass Circuit Breaker Switch (Q3):** Controls AC input power to the UPS system during manual bypass operation.

**N** **Output Circuit Breaker Switch (Q4):** Controls AC output power.

## 1.3 Operating Principles

### 1.3.1 System Layout

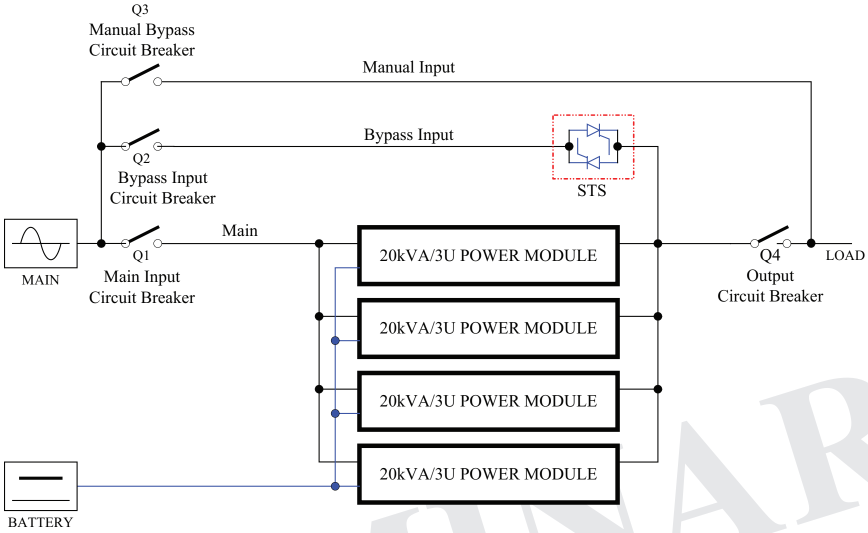

Q3
Manual Bypass
Circuit Breaker
Manual Input
Bypass Input
STS
Q2
Bypass Input
Circuit Breaker
Main
MAIN
Q1
Main Input
Circuit Breaker
20kVA/3U POWER MODULE
20kVA/3U POWER MODULE
20kVA/3U POWER MODULE
20kVA/3U POWER MODULE
Q4
Output
Circuit Breaker
LOAD
BATTERY

*Fig 1.3.1a System Block Diagram for KX models*

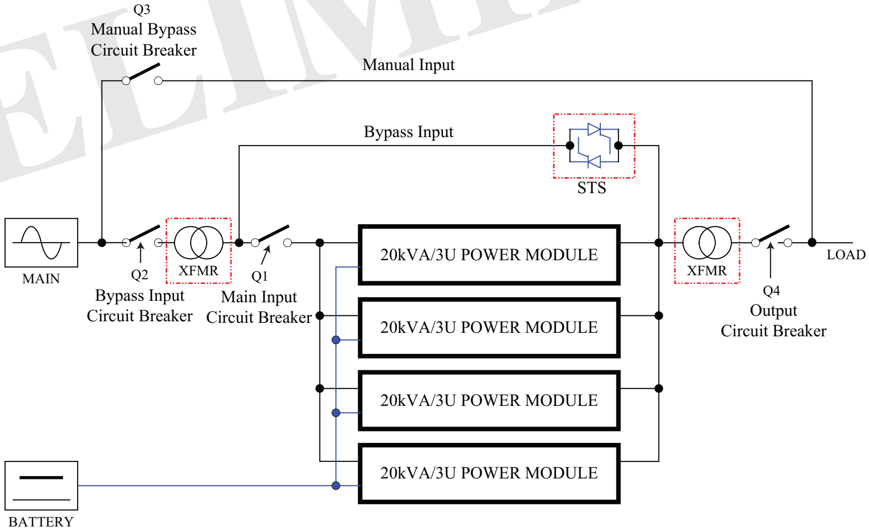

Q3
Manual Bypass
Circuit Breaker
Manual Input
Bypass Input
STS
MAIN
Q2
Bypass Input
Circuit Breaker
XFMR
Q1
Main Input
Circuit Breaker
20kVA/3U POWER MODULE
20kVA/3U POWER MODULE
20kVA/3U POWER MODULE
20kVA/3U POWER MODULE
XFMR
Q4
Output
Circuit Breaker
LOAD
BATTERY

*Fig 1.3.1b System Block Diagram for K and KTV models*

The SU-Series 3-Phase UPS is configured with 3-phase 20kVA power modules that can be paralleled for redundancy or capacity upgrades. Each KX- (Figure 1.3.1a), K- , and KTV-series (Figure 1.3.1b) UPS includes three key functions:

1) A *central bypass static switch*, which causes a critical load to automatically bypass any overload or fault conditions that occur.

2) A *maintenance bypass switch*, which eliminates UPS faults by supplying a critical load.

3) A *matched transformer*, which increases and decreases the input/output voltage

### 1.3.2 Internal Battery Layout

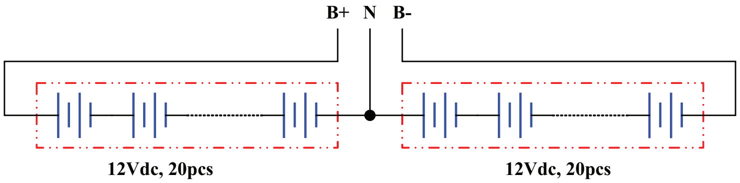

B+
N
B-
12Vdc, 20pcs
12Vdc, 20pcs

*Fig 1.3.2a Battery Strings*

An internal battery pack (number of packs vary by model) supplies the UPS system with battery backup power. Each internal battery pack consists of 40 12Vdc VRLA batteries arranged in two strings: one string of 20 positive batteries (black cable) and one string of 20 negative batteries (red cable). The two strings are connected by a neutral (N) point (Figure 1.3.2a).

## 1.3 Operating Principles *(continued)*

### 1.3.3 Power Module Layout

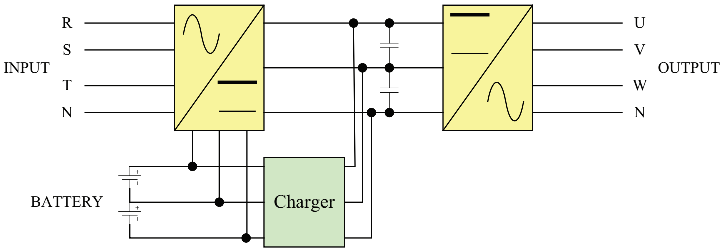


*Fig 1.3.3a Power Module Block Diagram*

The SU-Series 3-Phase UPS double-conversion power modules consist of three components (Figure 1.3.3a):

1) An AC/DC converter

2) An AC/DC inverter

3) A charger

The power module's 3-phase, 4-wire input runs A/C current through the AC/DC converter to generate regulative dual DC bus (±370Vdc). During backup mode, this current is provided by battery power.

The dual DC bus then runs through the AC/DC inverter to generate a pure sine wave of AC power (3-phase, 4-wire). The DC bus also charges the dual battery strings by running current through the charger. Each power module has a maximum charge current of 5 A.

## 1.4 Opening and Closing the Unit

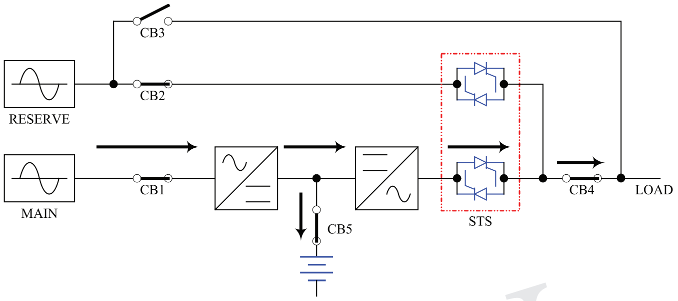
**[PENDING]**

## 1.5 Operating Modes

This section provides a basic description of the UPS system's operating modes. For more information about switching between operating modes, refer to **Section 1.6 – Start-Up, Shutdown and Bypass**.

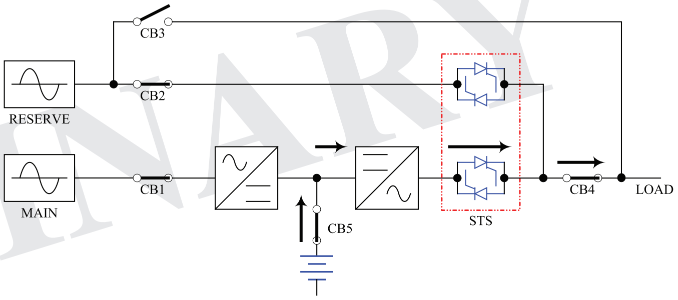
### 1.5.1 Online (Normal) Mode (Single UPS)

In online (normal) mode, the UPS system's rectifier converts incoming AC utility power to DC power that charges the batteries and supplies the inverter. The inverter transforms the DC power to precision-regulated, pure sine wave AC power that supports the operation of connected equipment. This dual conversion technology isolates connected equipment from all power problems and ensures that connected equipment receives ideal power at all times.



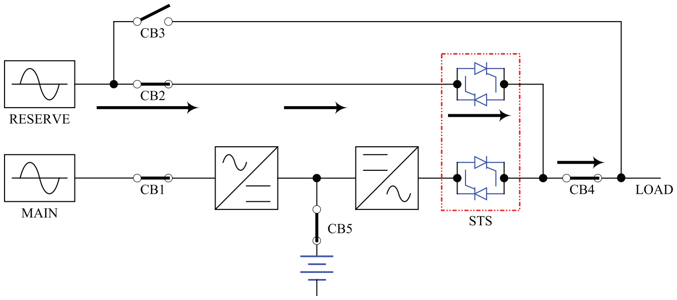
### 1.5.2 Battery Backup Mode (Single UPS)

When a blackout or other extreme power event occurs, the UPS system automatically switches from normal mode to battery backup mode. The UPS system's batteries (internal and/or external) provide emergency DC power to the inverter. The inverter transforms the DC power to precision-regulated, pure sine wave AC power that supports the operation of connected equipment.



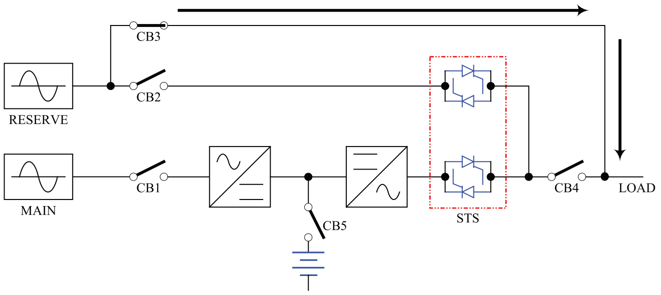
### 1.5.3 Auto Bypass Mode (Single UPS)

If the inverter malfunctions due to excessive temperature, overload, output short circuit, abnormal voltage or battery problems, the inverter will shut down. If the UPS system detects a bypass (reserve) power source that conforms to normal parameters, then the UPS system automatically switches to auto bypass mode to continue supplying power to connected equipment. When all problems are eliminated, the UPS system switches back to online (normal) mode automatically.



### 1.5.4 Manual Bypass Mode (Single UPS)

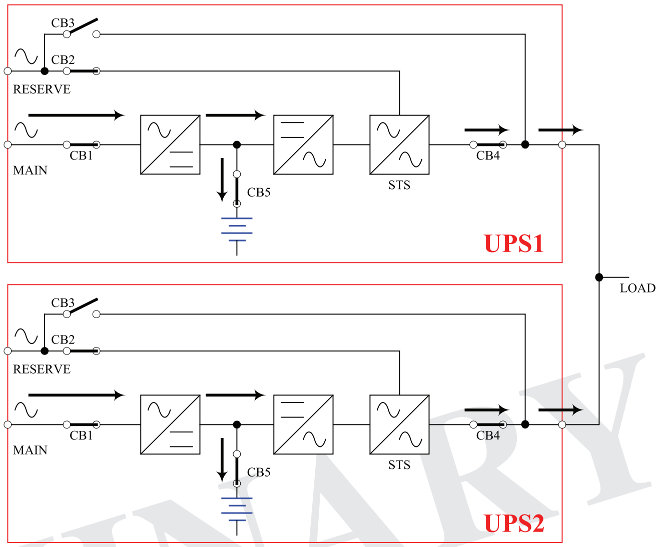
If UPS system maintenance or repair is required, you can bypass the UPS system and enable bypass (reserve) power manually. After confirming that bypass (reserve) power is present, switch the UPS system into manual bypass mode. This allows service technicians to perform maintenance or repair jobs without interrupting the flow of AC power to connected equipment. **Warning: The UPS system must be de-energized completely before performing maintenance or repair by shutting it down completely after switching it to manual bypass mode.**



## 1.5 Operating Modes *(continued)*

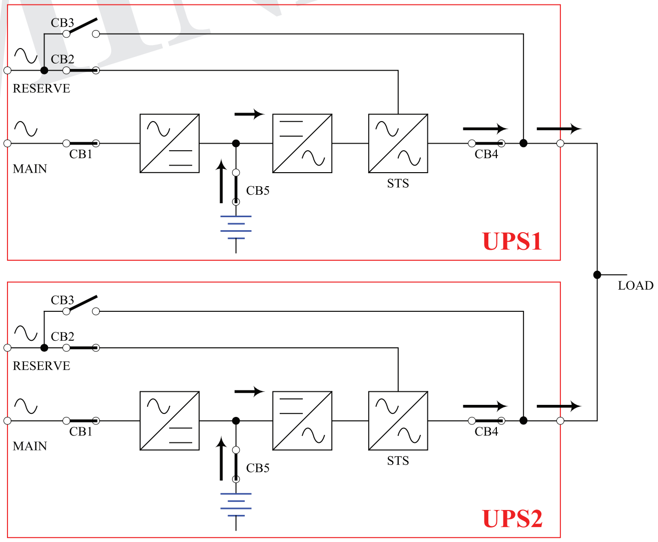
### 1.5.5 Online Mode (Parallel UPS)

Parallel redundancy (1+1) provides UPS system redundancy or increased total capacity. Under parallel redundancy, the total load is shared by two UPS systems. If one of the UPS systems malfunctions, the total connected equipment load is supported by the remaining UPS system. If the total load exceeds the capacity of the remaining UPS system, it will switch to auto bypass mode.


CB3
CB2
RESERVE
CB1
MAIN
CB5
STS
CB4
UPS1
LOAD
CB3
CB2
RESERVE
CB1
MAIN
CB5
STS
CB4
UPS2

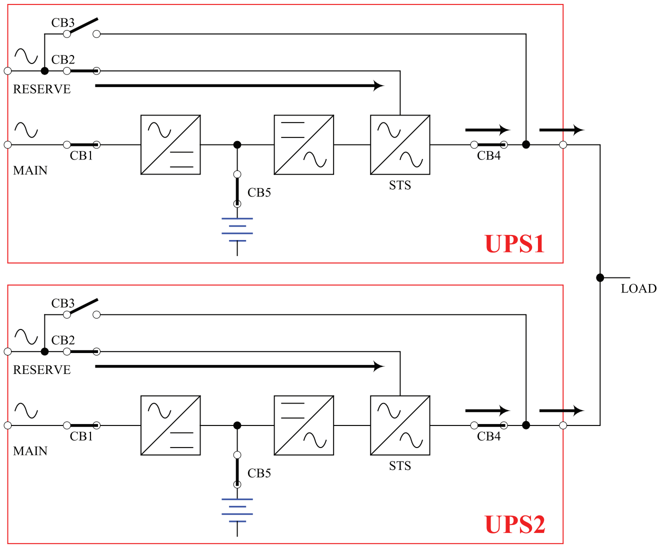
### 1.5.6 Battery Backup Mode (Parallel UPS)

Similar to on battery backup mode for a single UPS system (**Section 1.5.2**), except the total connected equipment load is shared by the parallel (1+1) UPS systems.


CB3
CB2
RESERVE
CB1
MAIN
CB5
STS
CB4
UPS1
LOAD
CB3
CB2
RESERVE
CB1
MAIN
CB5
STS
CB4
UPS2

### 1.5.7 Auto Bypass Mode (Parallel UPS)

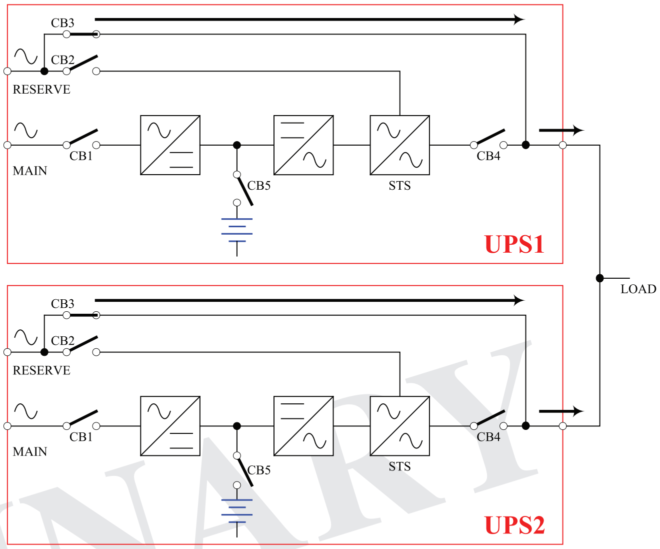
Similar to auto bypass mode for a single UPS system (**Section 1.5.3**), except with parallel (1+1) UPS systems.


CB3
CB2
RESERVE
CB1
MAIN
CB5
STS
CB4
UPS1
LOAD
CB3
CB2
RESERVE
CB1
MAIN
CB5
STS
CB4
UPS2

## 1.5 Operating Modes *(continued)*

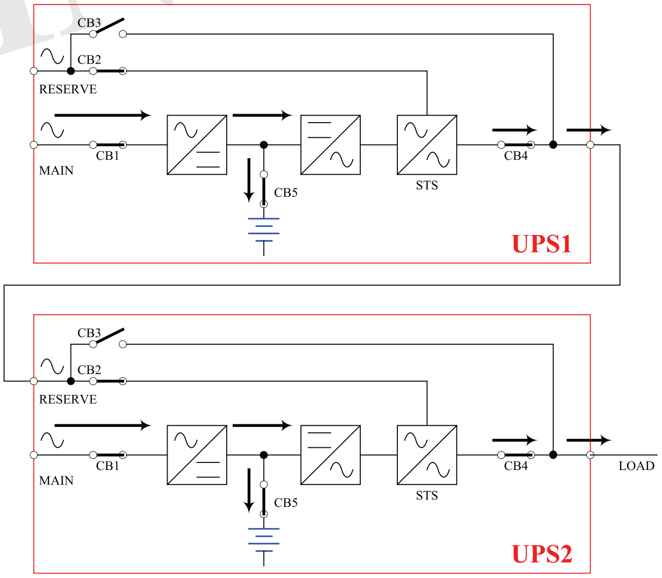
### 1.5.8 Manual Bypass Mode (Parallel UPS)

Similar to manual bypass mode for a single UPS system (**Section 1.5.4**), except with parallel (1+1) UPS systems. ***Note:*** *Both UPS systems must be switched into manual bypass mode.*


CB3
CB2
RESERVE
MAIN
CB1
CB5
STS
CB4
UPS1
LOAD
CB3
CB2
RESERVE
MAIN
CB1
CB5
STS
CB4
UPS2

### 1.5.9 Hot Standby Mode (Parallel UPS)

For added fault-tolerance, the redundant UPS system acts as the bypass (reserve) power source for the main UPS system.

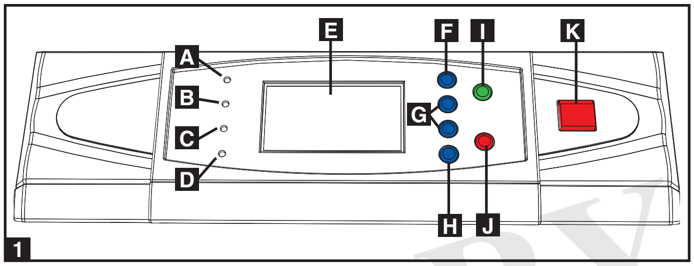

CB3
CB2
RESERVE
MAIN
CB1
CB5
STS
CB4
UPS1
CB3
CB2
RESERVE
MAIN
CB1
CB5
STS
CB4
LOAD
UPS2

## 1.6 Start-Up, Shutdown and Bypass

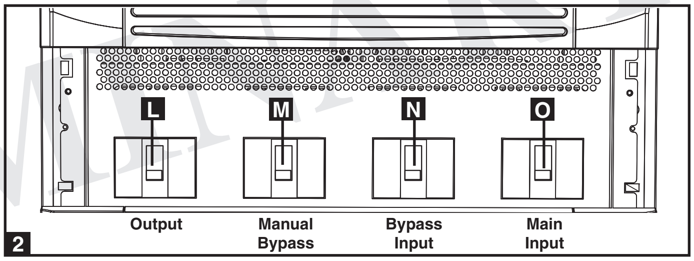
**Warning: The UPS system's output voltage is set at 220/380V by default. If you require output voltage of 230/400V or 240/415V, you must change the UPS system's output voltage by accessing the output setup menu described in Section 10-9 of the owner's manual. You must place the UPS system in bypass mode before changing the output voltage. Do not connect your equipment to the UPS system's output until you have set the proper parameters.**

### 1.6.1 Control Panel and Breaker Diagrams

**A** **"NORMAL" LED**
**B** **"BATTERY" LED**
**C** **"BYPASS" LED**
**D** **"FAULT" LED**
**E** **LCD Status Screen**
**F** **"ESC" (Escape) Button**
**G** **Scroll Buttons (▲ and ▼)**
**H** **Enter Button (↵)**
**I** **ON Button**
**J** **OFF Button**
**K** **"EPO" (Emergency Power Off) Button**
**L** **Output Circuit Breaker Switch**
**M** **Manual Bypass Circuit Breaker Switch**
**N** **Bypass Input Circuit Breaker Switch**
**O** **Main Input Circuit Breaker Switch**



*Control Panel*



*Circuit Breaker Switches (UPS System Front Panel)*

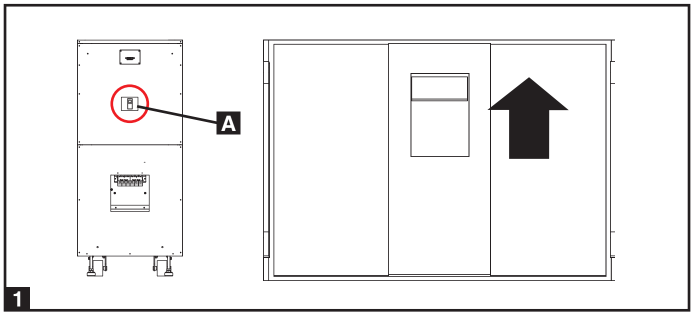
### 1.6.2 Preliminary Checklist (Single UPS)

- All circuit breaker switches should be off, including the breaker of the external battery cabinet (if present).
- Confirm that no voltage potential exists between Neutral and Ground.
- Confirm that the input power source matches the rating (voltage, frequency and phase) of the UPS system.

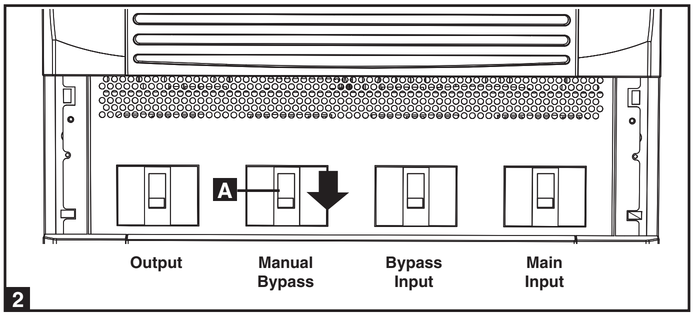
***Note:** After start-up, the UPS system will perform a brief self-test and display the results on the LCD screen. After a successful self-test, the UPS system will provide AC power to the connected equipment load.*

### 1.6.3 Standard Start-Up Procedure (Single UPS)

**1** If there is an external battery cabinet connected, switch on the circuit breaker **A** of the external battery cabinet.



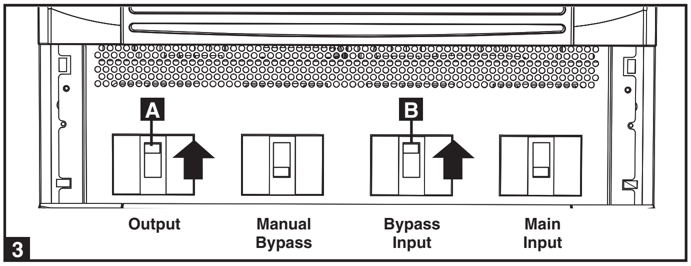
**2** Confirm that the manual bypass circuit breaker switch **A** is off.



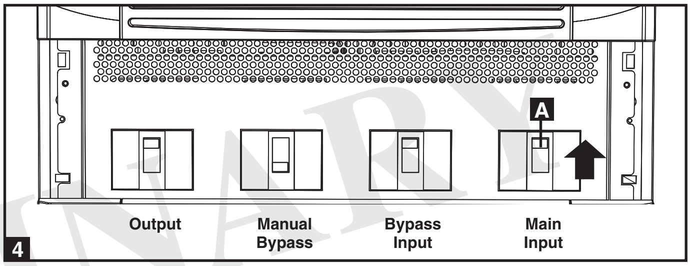
## 1.6 Start-Up, Shutdown and Bypass *(continued)*

### 1.6.3 Standard Start-Up Procedure (Single UPS) (continued)

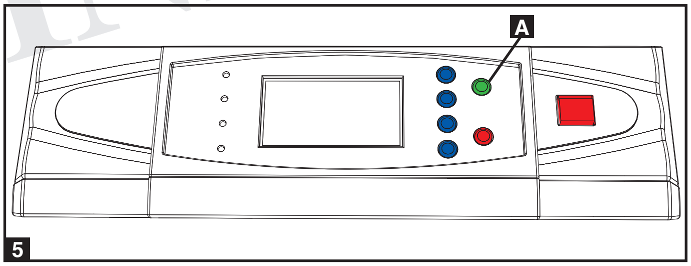
3 Switch on the output circuit breaker switch A and bypass input circuit breaker switch B. After a brief initialization process, the LCD screen will show “ON AUTO BYPASS”, the “BYPASS” LED will illuminate and UPS system output will be supplied by the bypass (reserve) power source.


A
B
Output
Manual Bypass
Bypass Input
Main Input
3

4 Switch on the main input circuit breaker switch A. If the AC input power source is normal, the UPS system is ready for start-up.


A
Output
Manual Bypass
Bypass Input
Main Input
4

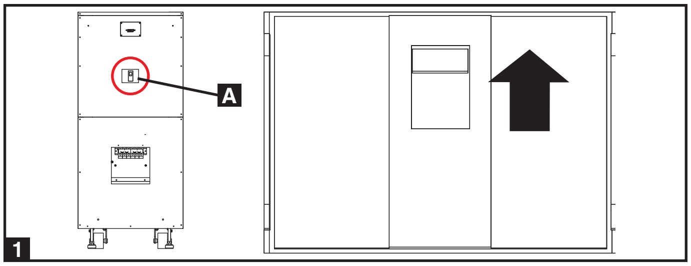
5 Press the ON button A for 3 seconds (until you hear a beep), then release the button. The inverter will activate and synchronize with the bypass source, then automatically switch from auto bypass (reserve) mode to online (normal) mode. The “BYPASS” LED will darken and the “NORMAL” LED will illuminate.



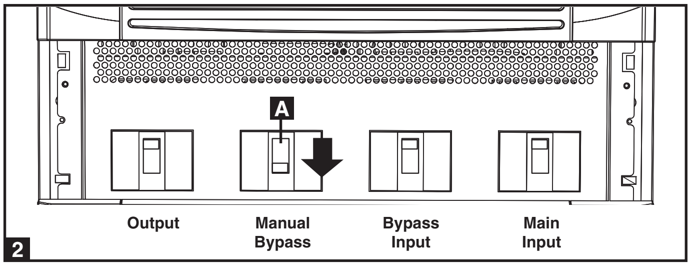
### 1.6.4 Battery Start-Up Procedure (Single UPS)

***Note:*** *The battery must be at least partially charged for this operation to succeed.*

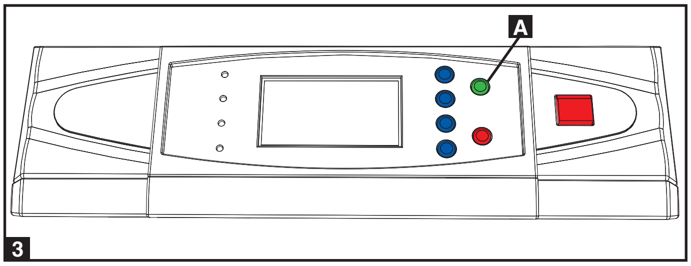
1 If there is an external battery cabinet connected, switch on the circuit breaker A of the external battery cabinet.



2 Confirm that the manual bypass circuit breaker switch A is off.


A
Output
Manual Bypass
Bypass Input
Main Input
2

3 Press the ON button A for 3 seconds (until you hear a beep), then release the button. The inverter will activate and use stored DC battery power to supply AC power to connected equipment. The “BATTERY” LED will illuminate.

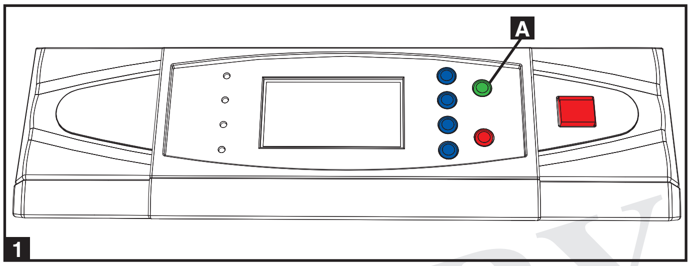


## 1.6 Start-Up, Shutdown and Bypass *(continued)*

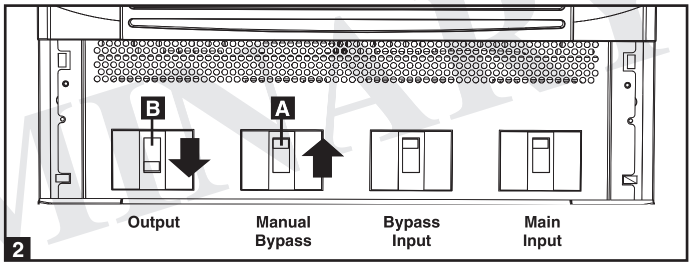
### 1.6.5 Manual Bypass Procedure (Single UPS)

**Warning: Placing the UPS system in manual bypass will disable the inverter and power all loads from the manual bypass (reserve) source, but the UPS system will still be energized. Before performing maintenance or repair on the UPS system, shut down and de-energize the UPS system completely by following the steps in Section 1.6.6. Although connected equipment loads will be powered by the bypass (reserve) power source, they will not receive battery backup in the event of a utility power failure.**

1 When the UPS system is in online (normal) mode, press the ON button **A** for 3 seconds (until you hear a beep), then release the button. The inverter will automatically switch to bypass mode and the "BYPASS" LED will illuminate.



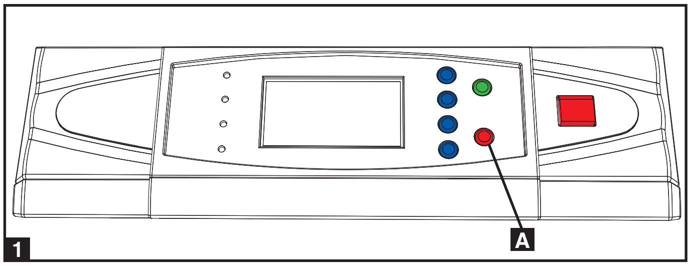
2 Switch on the manual bypass circuit breaker switch **A**, then switch off the output circuit breaker switch **B**.



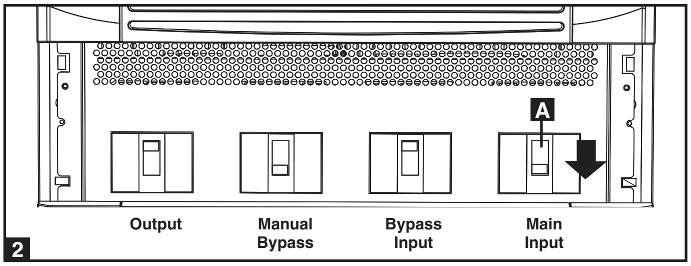
### 1.6.6 Shutdown Procedure (Single UPS)

**Warning: The UPS system shutdown procedure will eliminate the AC power output for all loads. Before shutdown, confirm that all loads are turned off or place the UPS system in manual bypass mode to keep loads powered by the reserve (bypass) power source.**

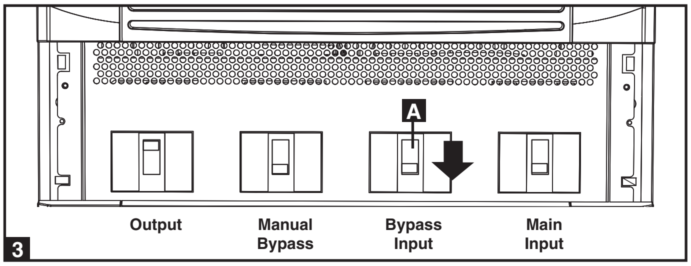
1 Press the OFF button **A** for 3 seconds (until you hear a beep), then release the button. If the UPS system is in online (normal) mode, it will switch to bypass mode. If the UPS system is in battery backup mode, the inverter will shut down and AC output power will be interrupted.



2 Switch off the main input circuit breaker switch **A**.



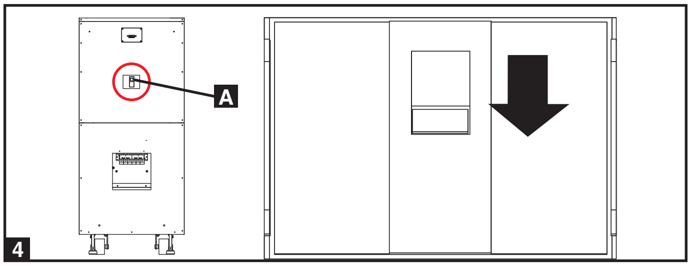
3 Switch off the bypass input circuit breaker switch **A**.



## 1.6 Start-Up, Shutdown and Bypass *(continued)*

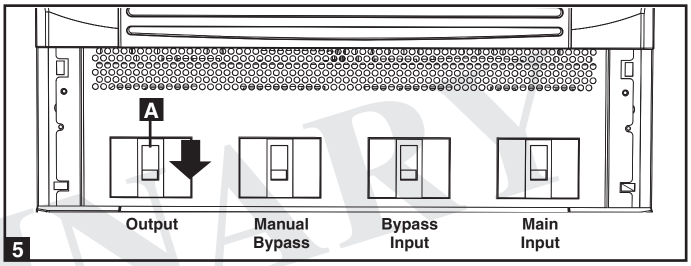
### 1.6.6 Shutdown Procedure (Single UPS) (continued)

**4** Confirm that the UPS system is off and that all main output circuits are off. If the UPS system is connected to an external battery cabinet, turn off the external battery cabinet circuit breaker switch **A**.



**5** Switch off the output circuit breaker switch **A**. If the AC input power source is normal, the UPS system is ready for start-up.

***Note:*** *If the UPS system remains off for an extended period of time, it should be turned on periodically to allow the batteries to recharge. The UPS system should be turned on and the batteries should be recharged at least one uninterrupted 24-hour period every 3 months. Failure to recharge the batteries periodically may cause irreversible battery damage.*



### 1.6.7 Preliminary Checklist (Parallel UPS)

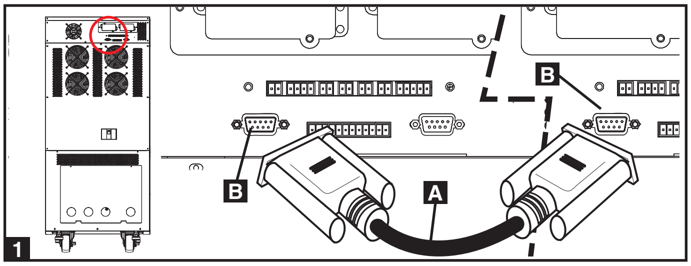
**Warning: Parallel redundancy requires exactly two UPS systems (1+1 redundancy ). Do not attempt to link more than two UPS systems via parallel redundancy. The UPS systems must have the same rating and capacity for parallel redundancy installation. Attempting to link dissimilar UPS systems will damage the UPS systems and create a serious risk of personal injury and property damage.**

- All circuit breaker switches should be off, including the breakers of the external battery cabinets.
- Confirm that no voltage potential exists between Neutral and Ground.
- Confirm that the input power source matches the rating (voltage, frequency and phase) of the UPS systems.
- **You must use the control panel to set the parallel ID numbers of the UPS systems to be 1 and 2. See section 10-11 of the owner's manual for information about setting the parallel ID numbers.**

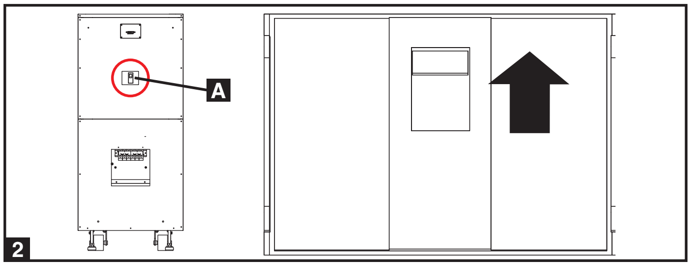
***Note:*** *After start-up, the UPS systems will perform a brief self-test and display the results on the LCD screen. After a successful self-test, the UPS systems will provide AC power to the connected equipment load.*

### 1.6.8 Start-Up Procedure (Parallel UPS)

**1** Connect the parallel redundancy cable **A** to the DB9 parallel redundancy port **B** of each UPS system.



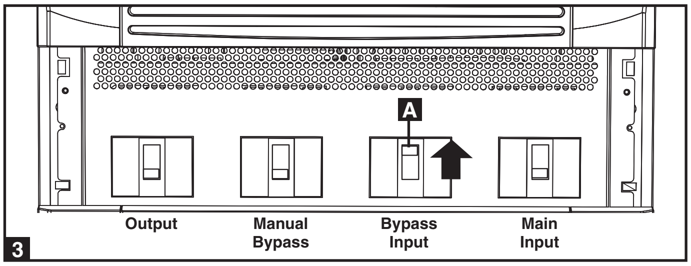
**2** If the UPS systems have external battery cabinets connected, switch on the external battery cabinet circuit breaker switch **A** of each battery pack.



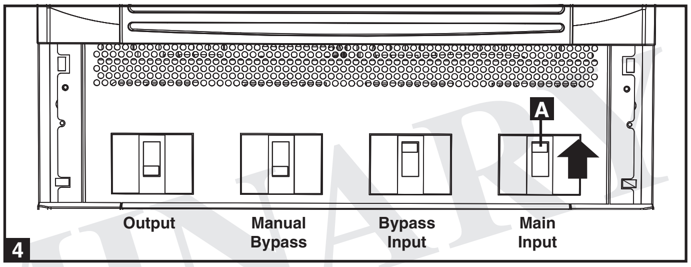
## 1.6 Start-Up, Shutdown and Bypass *(continued)*

### 1.6.8 Start-Up Procedure (Parallel UPS) (continued)

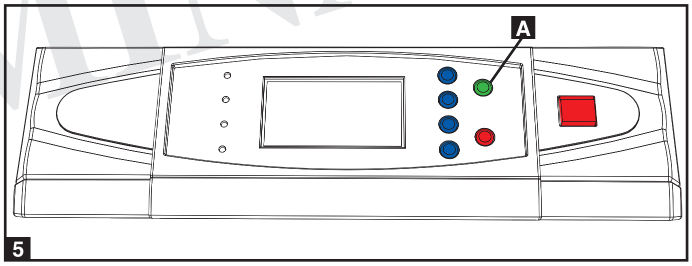
3 Switch on the bypass input circuit breaker switch A of each UPS system. After a brief initialization process, the LCD screen will show “ON AUTO BYPASS” and the “BYPASS” LED will illuminate.



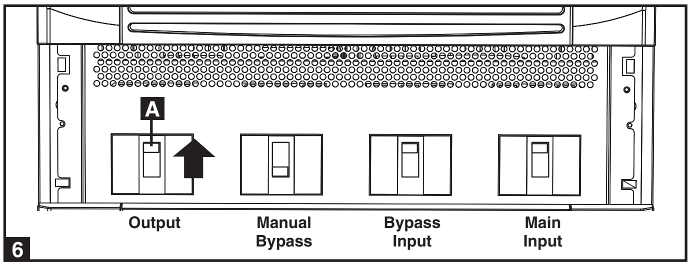
4 Switch on the main input circuit breaker switch A of each UPS system.



5 Press the ON button A of one of the UPS systems for 3 seconds (until you hear a beep), then release the button. The inverter will activate and synchronize with the bypass source. Press the ON button for the other UPS system for 3 seconds (until you hear a beep), then release the button. When the inverter of each UPS system is operating normally, they will automatically switch from auto bypass (reserve) mode to online (normal) mode at the same time. The “BYPASS” LED will darken and the “NORMAL” LED will illuminate.



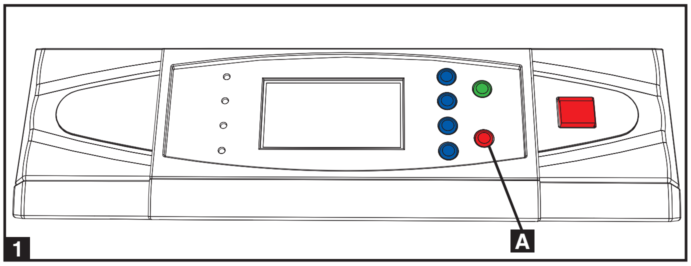
6 Check the output voltage of each UPS system. The phase deviation between each UPS system should be less than 5V. If the phase deviation is within the acceptable range, switch on the output circuit breaker switch A of each UPS system. Note: For more information on checking the output voltage of each UPS system, see section 10-6 of the owner’s manual.



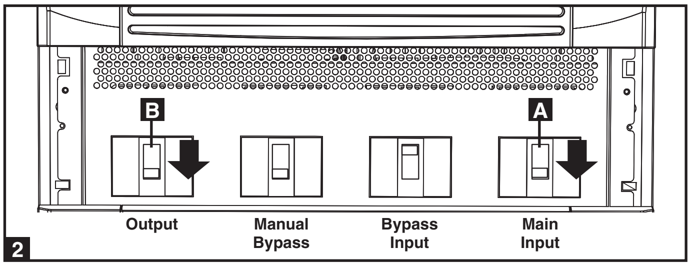
### 1.6.9 Shutdown Procedure (Parallel UPS)

**Warning: The UPS system shutdown procedure will eliminate the AC power output for all loads. Before shutdown, confirm that all loads are turned off or place the UPS systems in manual bypass mode to keep loads powered by the bypass (reserve) power source.**

1 For the UPS system you wish to shut down, press the OFF button A for 3 seconds (until you hear a beep), then release the button. If the other UPS system can support the connected equipment loads alone, the UPS system that was turned off will shut down its inverter and its LCD screen will read “LOAD NOT POWERED”. The other UPS system’s LCD screen will read “ONLINE MODE”. If the total connected equipment load is too large to be handled by a single UPS system, both UPS systems will shut down their inverters and switch to bypass mode, and their LCD screens will read “ON AUTO BYPASS.”



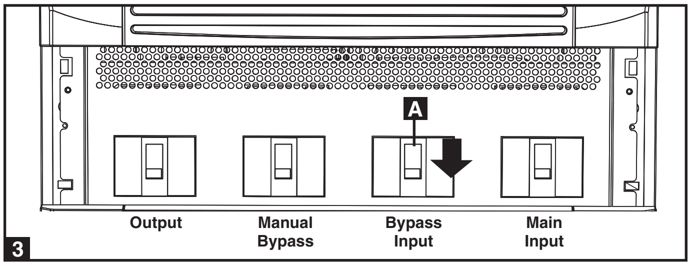
2 For the UPS system you wish to shut down, switch off the main input circuit breaker switch A, then switch off the output circuit breaker switch B.



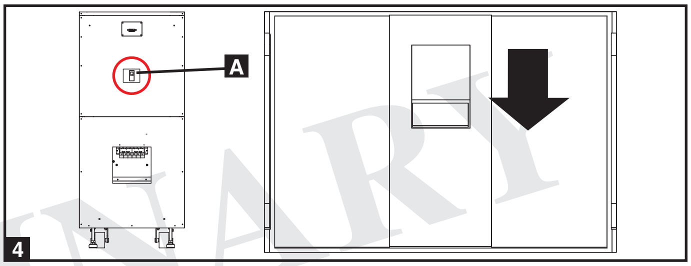
## 1.6 Start-Up, Shutdown and Bypass *(continued)*

### 1.6.9 Shutdown Procedure (Parallel UPS) (continued)

**3** For the UPS system you wish to shut down, switch off the bypass input circuit breaker switch **A**.



**4** When the UPS system is completely shut down, the LCD screen will be completely off. If the UPS systems have external battery cabinets connected, switch off the external battery cabinet circuit breaker switch **A** of each battery pack.

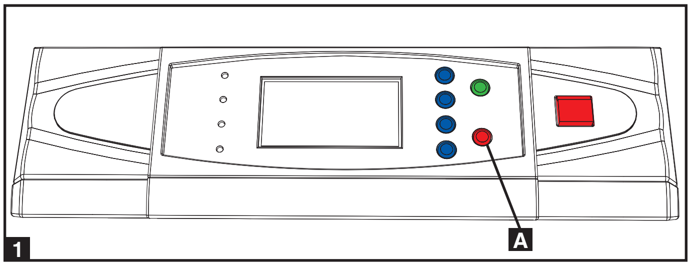


***Note:*** *If the UPS system remains off for an extended period of time, it should be turned on periodically to allow the batteries to recharge. The UPS system should be turned on and the batteries should be recharged at least one uninterrupted 24-hour period every 3 months. Failure to recharge the batteries periodically may cause irreversible battery damage.*

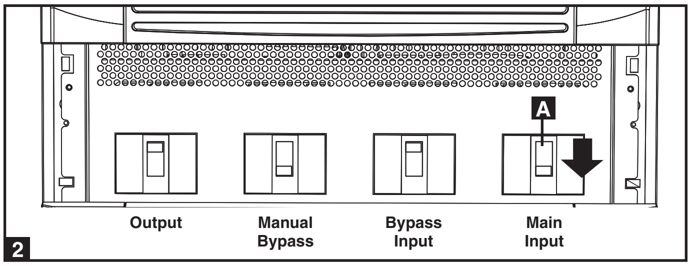
### 1.6.10 Manual Bypass Procedure (Parallel UPS)

**Warning: When the UPS system is in manual bypass, the inverter shuts down. Connected equipment loads are powered by the bypass (reserve) power source and will not receive battery backup during a utility power failure.**

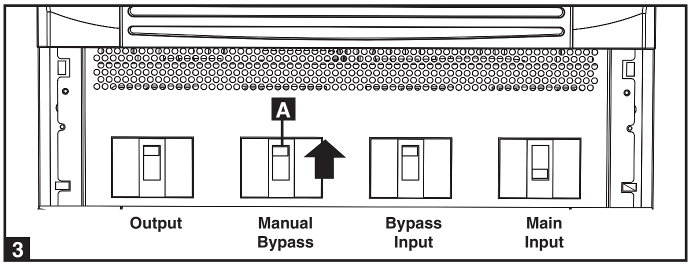
**1** For the first UPS system you wish to shut down, press the OFF button **A** for 3 seconds (until you hear a beep), then release the button. If the other UPS system can support the connected equipment loads alone, the UPS system that was turned off will shut down its inverter and its LCD screen will read "LOAD NOT POWERED". The other UPS system's LCD screen will read "ONLINE MODE". If the total connected equipment load is too large to be handled by a single UPS system, both UPS systems will shut down their inverters and switch to bypass mode, and their LCD screens will read "ON AUTO BYPASS". Repeat step 1 for the second UPS system you wish to shut down.



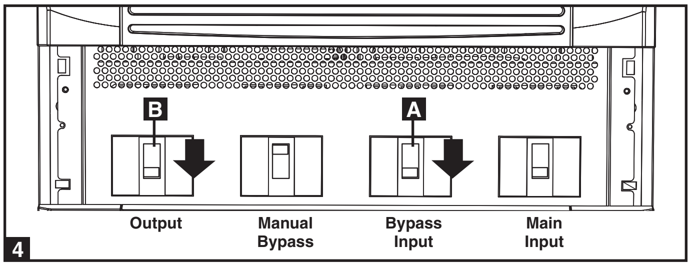
**2** Switch off the main input circuit breaker switch **A** of each UPS system.



**3** Confirm that both UPS systems are shut down, then switch on the manual bypass input circuit breaker switch **A** of each UPS system. The bypass (reserve) power source will power the loads and the LCD screen will read "ON MANUAL BYPASS."



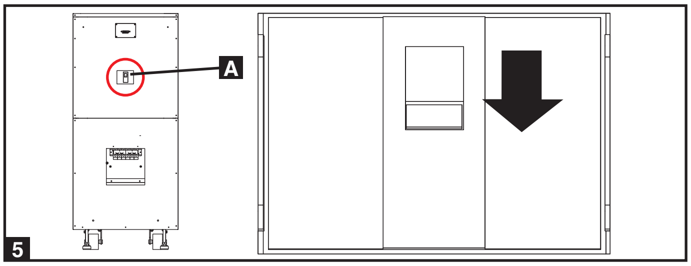
**4** Switch off the bypass input circuit breaker switch **A** and the output circuit breaker switch **B** of each UPS system. The LCD screen will turn off completely.



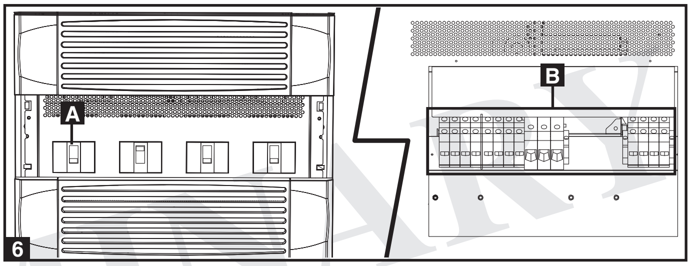
## 1.6 Start-Up, Shutdown and Bypass *(continued)*

### 1.6.10 Manual Bypass Procedure (Parallel UPS) (continued)

**5** If the UPS systems have external battery cabinets connected, switch off the external battery cabinet circuit breaker switch **A** of each battery pack.

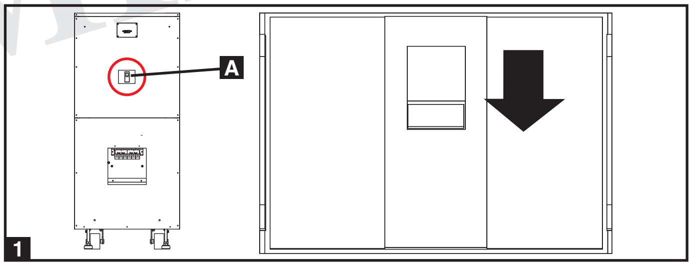


**6** In this mode, only the output circuit breaker switch **A** and the terminal block **B** contain hazardous voltage, allowing qualified service personnel to perform maintenance or repair. ***Note:*** *Qualified service personnel may prefer to de-energize the UPS systems completely, depending on local codes and the nature of the maintenance or repair.*

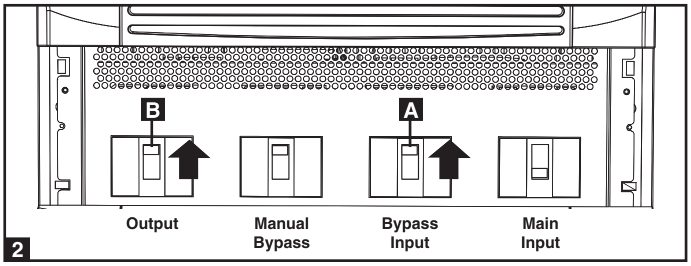


### 1.6.11 Switching from Manual Bypass to Normal Mode (Parallel UPS)

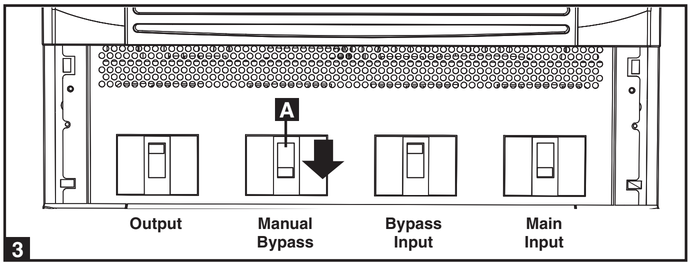
**1** If the UPS systems have external battery cabinets connected, switch off the external battery cabinet circuit breaker switch **A** of each battery pack.



**2** Switch on the bypass input circuit breaker switch **A** and the output circuit breaker switch **B** of each UPS system.

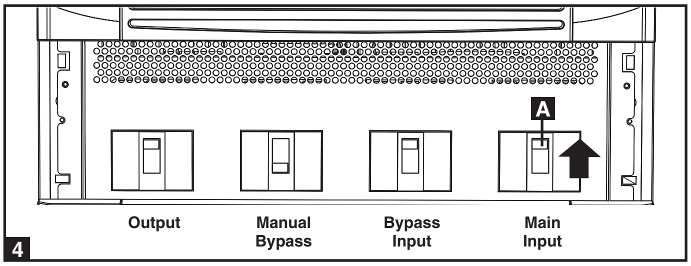


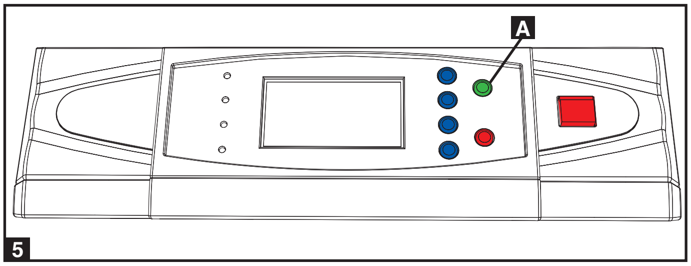
**3** Confirm that both UPS systems are shut down, then switch off the manual bypass input circuit breaker switch **A** of each UPS system. The LCD screen will read “ON AUTO BYPASS.”



**4** Switch on the main input circuit breaker switch **A** of each UPS system.

**5** Press the ON button **A** of the first UPS systems for 3 seconds (until you hear a beep), then release the button. Press the ON button for the second UPS system for 3 seconds (until you hear a beep), then release the button. When the inverter of each UPS system is operating normally, they will switch to online (normal) mode at the same time.





## 1.7 Printed Circuit Boards (PCB)

Table 1.7a lists the printed circuit boards present in each UPS system:

| SU80KX<br>SU80K<br>SU80KTV | SU60KX<br>SU60K | SU40KX<br>SU40K | SU20KX | PCB name | P/N | Description |
|---|---|---|---|---|---|---|
| TOP | | | | | | |
| V | V | V | V | NH-SYS-LCD | 16-5505001323 | Circuit for LCM, Circuit for LED and Function Key |
| V | V | V | V | NH-SYS-R | 16-5505001327 | Circuit for RS232, Output Dry Contact, Parallel Port, Connector to connect with each Power Module, Circuit for 2 Slots |
| V | V | V | V | NH-SYS-X | 16-5505001319 | Circuit for REPO, Input Dry Contact and Circuit for sense External Battery Cabinet Temperature |
| V | V | V | V | NH-SYS-M | 16-5505001321 | System MCU and Control Circuit |
| V | V | V | V | NH-SYS-P | 16-5505001325 | Auxiliary Power for System, Detect Circuit for Voltage and Current |
| V | V | V | V | NH-SYS-B | 16-5505001317 | EMI Filter for Battery Input |
| V | V | V | V | NH-SYS-LA | 16-5505001322 | Input EMI Filter for each Power Module |
| V | V | V | | NH-SYS-LB | 16-5505001353 | Input EMI Filter for each Power Module |
| V | V | | | NH-SYS-LC | 16-5505001354 | Input EMI Filter for each Power Module |
| V | | | | NH-SYS-LD | 16-5505001355 | Input EMI Filter for each Power Module |
| BOTTOM | | | | | | |
| | | V | V | NH-SYS-SA | 16-5505001370 | Driver Circuit for Bypass SCR |
| V | V | | | NH-SYS-S | 16-5505001326 | Driver Circuit for Bypass SCR |
| V | V | V | V | NH-SYS-FC | 16-5505001349 | Output EMI Filter |
| V (2pcs) | V (2pcs) | | | NH-SYS-F1(BYP) | 16-5505001371 | Input EMI Filter for Bypass |
| V (2pcs) | V (2pcs) | | | NH-SYS-F1(MAIN) | 16-5505001371 | Input EMI Filter for Main |
| V | V | | | NH-SYS-F2(MAIN) | 16-5505001373 | Input EMI Filter for Bypass |
| V | V | | | NH-SYS-F2(BYP) | 16-5505001374 | Input EMI Filter for Main |
| V | V | | | NH-SYS-F3 | 16-5505001372 | Circuit for Surge suppress |
| | | V (2pcs) | V (2pcs) | NH-SYS-FA | 16-5505001347 | Input EMI Filter |
| V | V | V | V | NH-SYS-FB | 16-5505001346 | Circuit for Bypass Back-feed Detect |

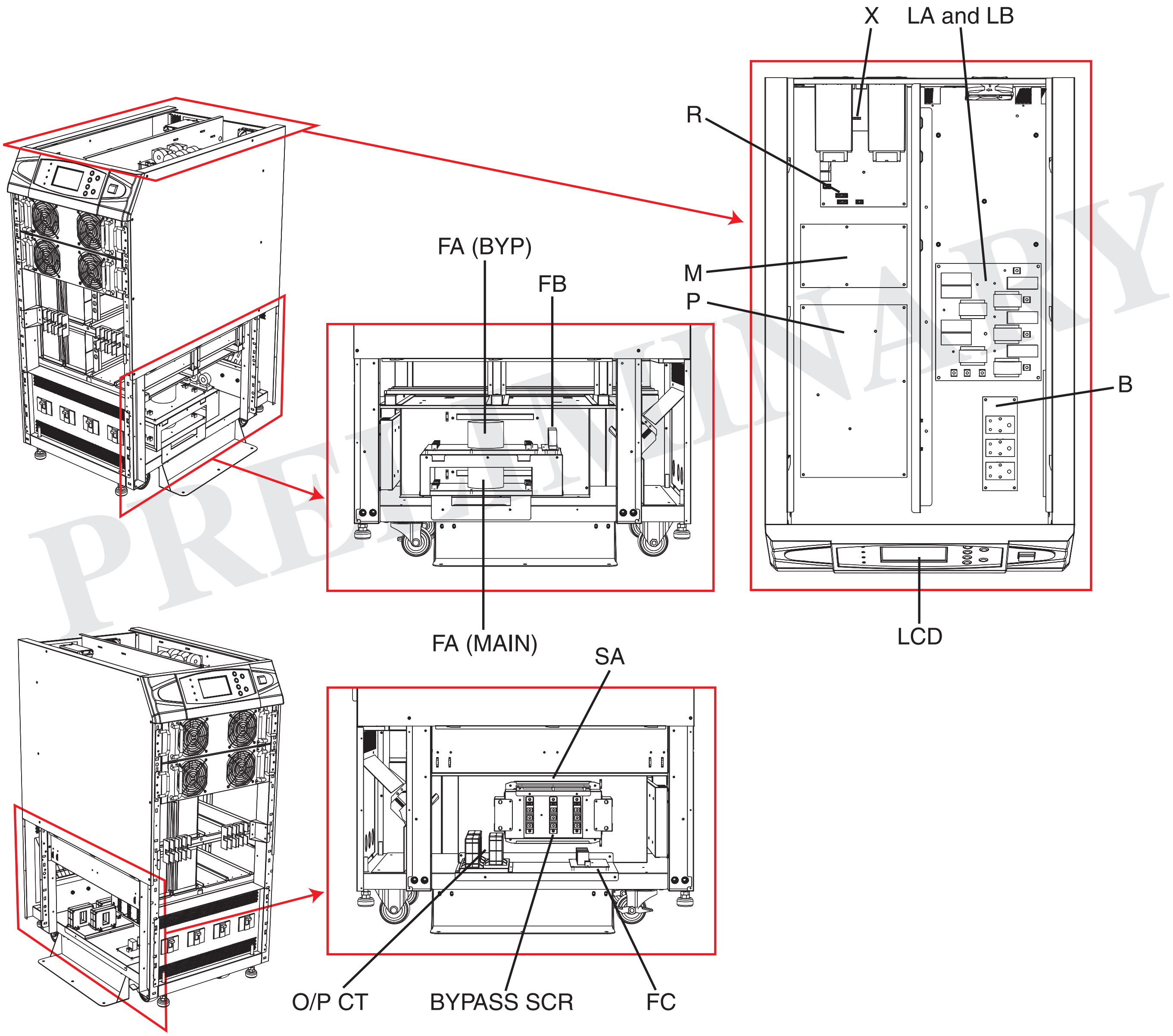
*Table 1.7a*

## 1.7 Printed Circuit Boards (PCB) *(continued)*

### 1.7.1 PCB Location (System)

#### 1.7.1.1 KX Models

SU20KX and SU40KX:

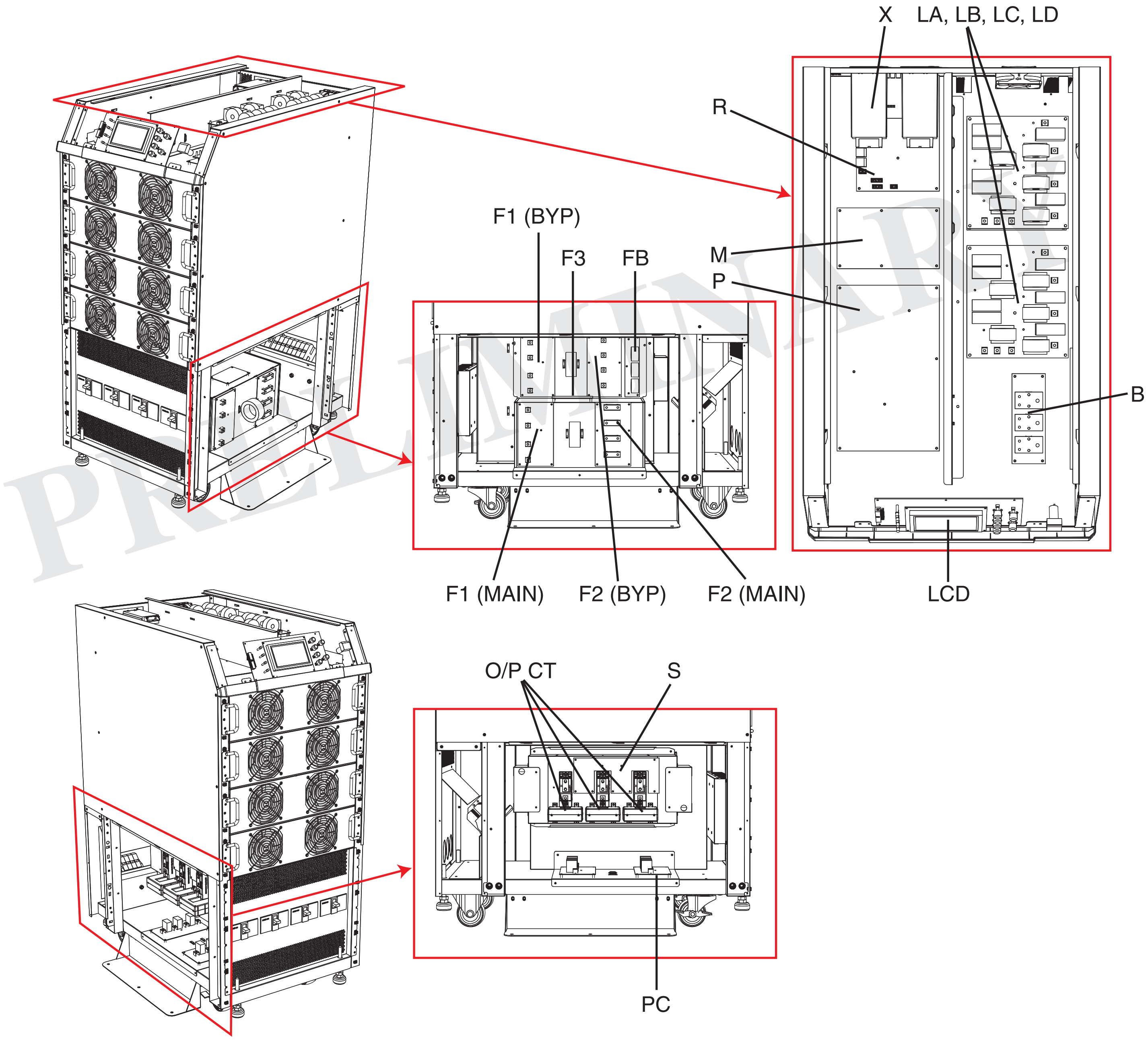

X
LA and LB
R
FA (BYP)
FB
M
P
B
FA (MAIN)
LCD
SA
O/P CT
BYPASS SCR
FC

## 1.7 Printed Circuit Boards (PCB) *(continued)*

### 1.7.1 PCB Location (System) *(continued)*

### 1.7.1.1 KX Models *(continued)*

SU60KX and SU80KX:

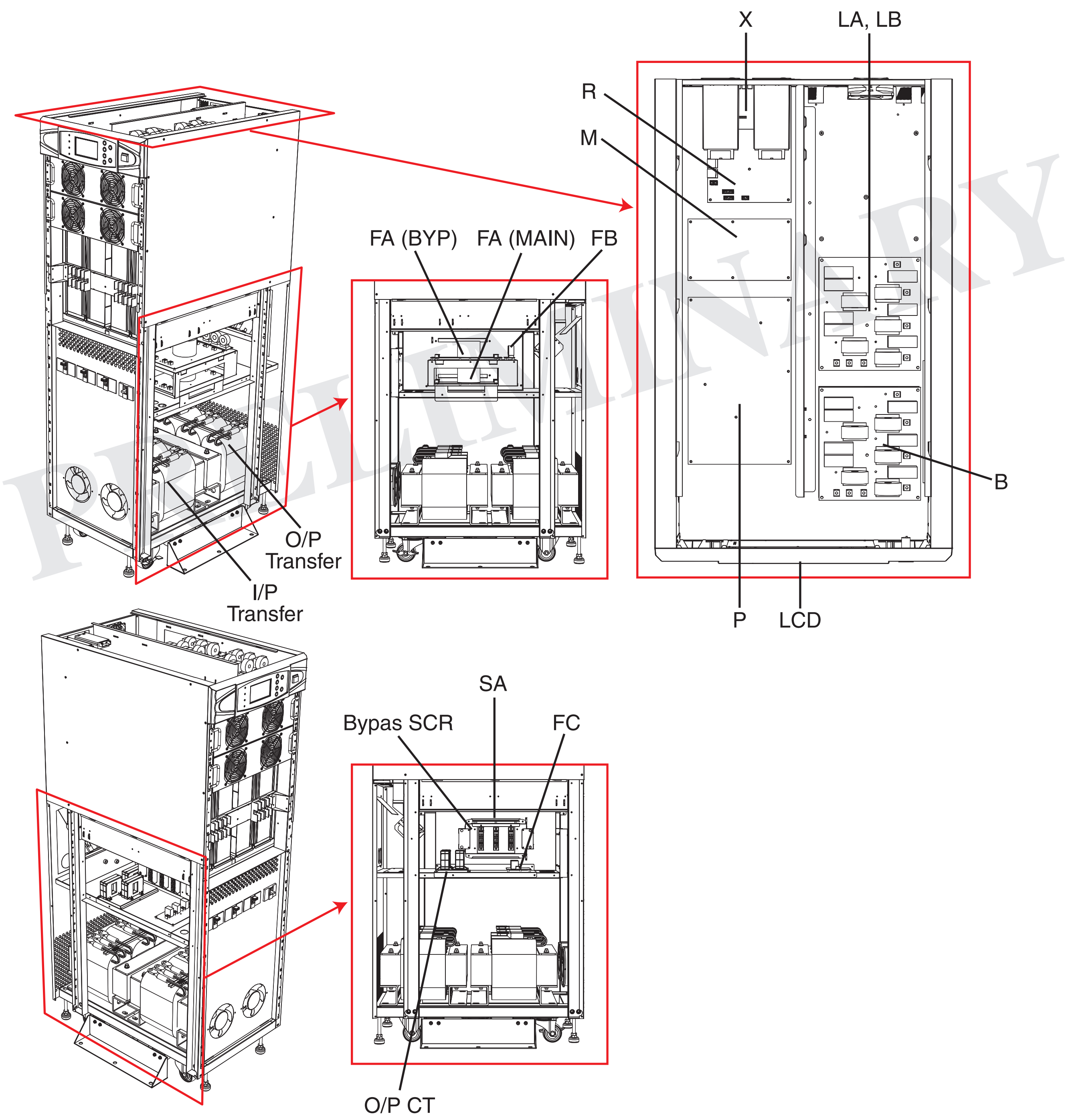

X
LA, LB, LC, LD
R
F1 (BYP)
F3
FB
M
P
B
F1 (MAIN)
F2 (BYP)
F2 (MAIN)
LCD
O/P CT
S
PC

## 1.7 Printed Circuit Boards (PCB) *(continued)*

### 1.7.1 PCB Location (System) *(continued)*

#### 1.7.1.2 K Models

SU40K:

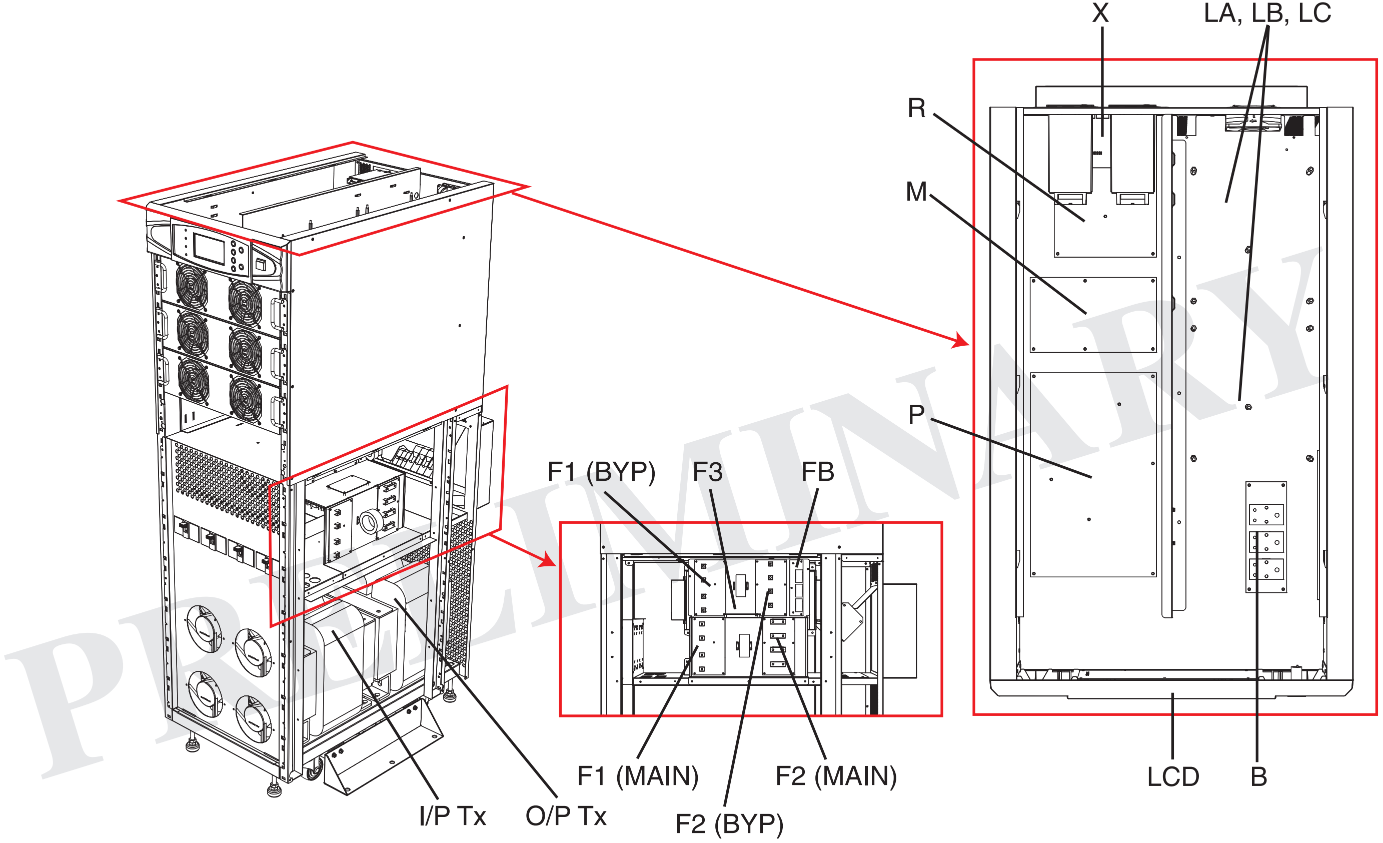

X
LA, LB
R
M
FA (BYP)
FA (MAIN)
FB
B
O/P Transfer
I/P Transfer
P
LCD
SA
Bypas SCR
FC
O/P CT

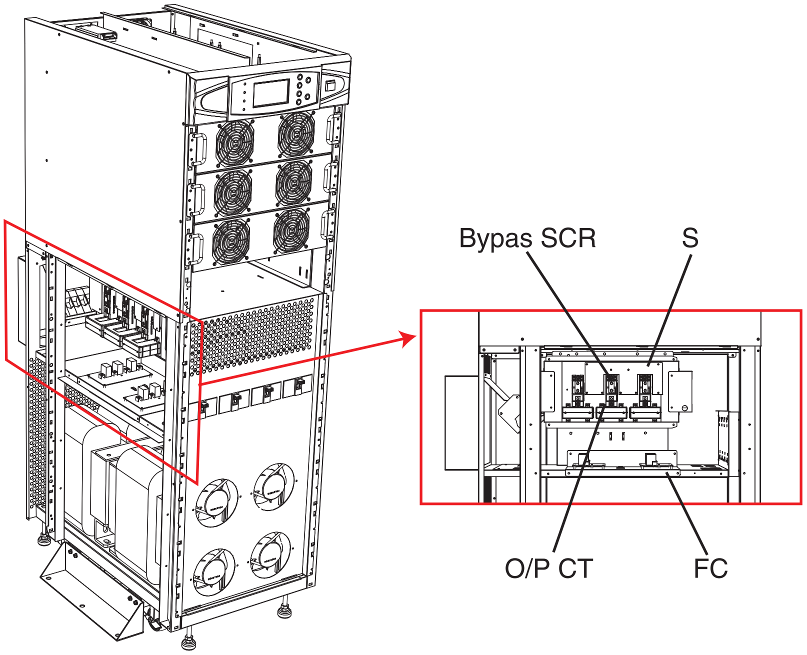
## 1.7 Printed Circuit Boards (PCB) *(continued)*

### 1.7.1 PCB Location (System) *(continued)*

#### 1.7.1.2 K Models *(continued)*

SU60K:


X
LA, LB, LC
R
M
P
F1 (BYP)
F3
FB
F1 (MAIN)
F2 (MAIN)
F2 (BYP)
I/P Tx
O/P Tx
LCD
B

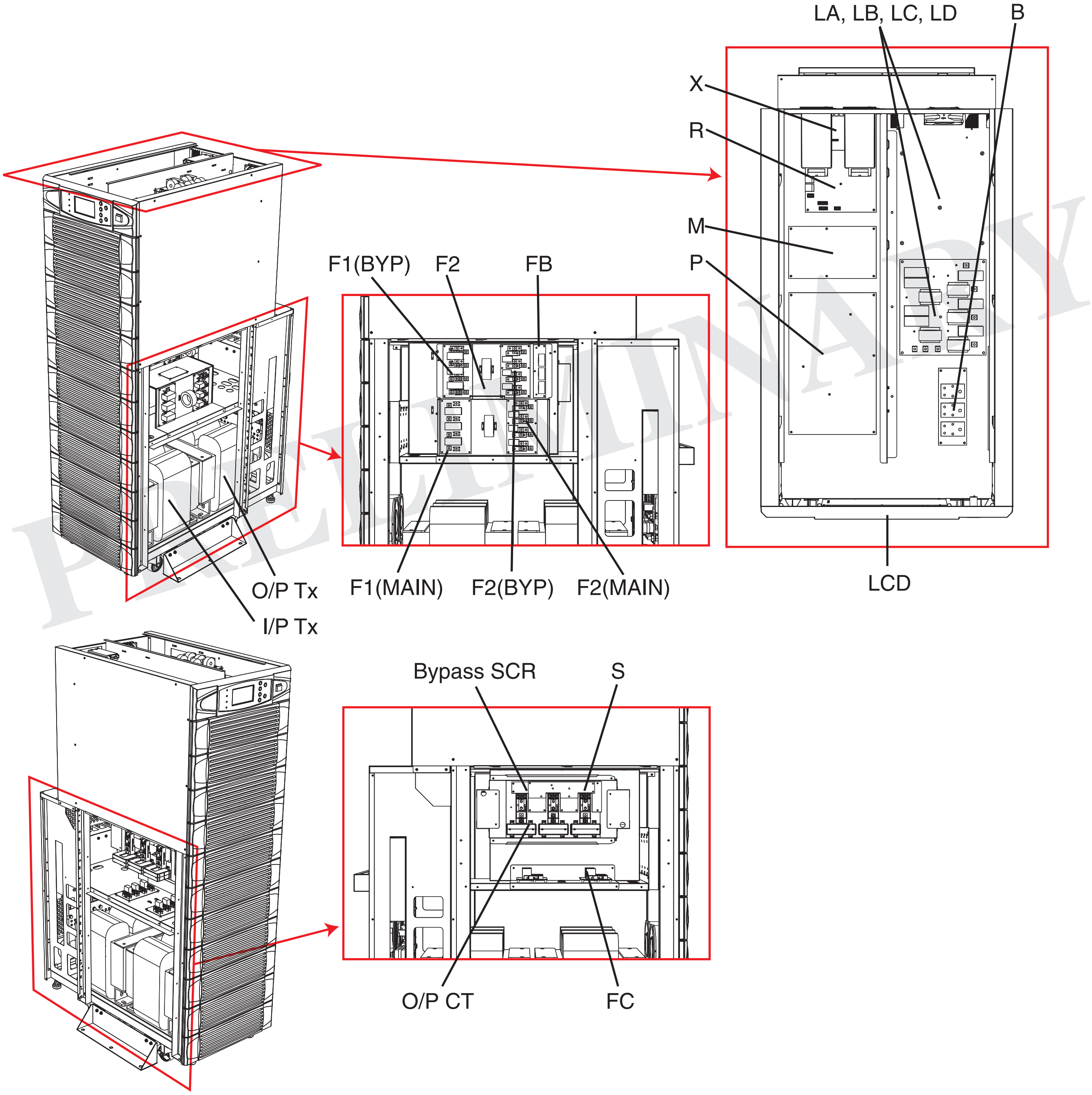

Bypas SCR
S
O/P CT
FC

## 1.7 Printed Circuit Boards (PCB) *(continued)*

### 1.7.1 PCB Location (System) *(continued)*

### 1.7.1.2 K Models *(continued)*

SU80K:


LA, LB, LC, LD
B
X
R
M
P
F1(BYP)
F2
FB
O/P Tx
I/P Tx
F1(MAIN)
F2(BYP)
F2(MAIN)
LCD
Bypass SCR
S
O/P CT
FC

## 1.7 Printed Circuit Boards (PCB) *(continued)*

### 1.7.2 PCB Location (Power Module)

| PCB Board Name | Description |
|---|---|
| NH-PM-A | Rectifier of Phase R and S, Inductance and Switching Devices of DC-DC Converter, Bus Capacitors and Battery SCR circuit |
| NH-PM-K | Rectifier of Phase T and S, Inductance and Switching Devices of DC-DC Converter, Bus Capacitors and Battery SCR circuit |
| NH-PM-C | Charger |
| NH-PM-P | Auxiliary Power |
| NH-PM-M | Control Circuit for PFC and Charger |
| NH-PM-DSP(PFC) | DSP Chip (Assemble on NH-PM-M Board) |
| NH-PM-B | Switching Devices of Inverter (Phase T) and Bus Capacitors |
| NH-PM-D | Switching Devices of Inverter (Phase R and S) and Bus Capacitors |
| NH-PM-L | LC Filter of Inverter, Current Sensor and Static Switch Circuit of Inverter |
| NH-PM-N | Control Circuit for Inverter |
| NH-PM-DSP(INV) | DSP Chip (Assemble on NH-PM-N Board) |
| NH-PM-H1 | External Connector of Power Module AC Input |
| NH-PM-H2 | External Connector of Power Module Battery Input |
| NH-PM-H3 | External Connector of Power Module AC Output |

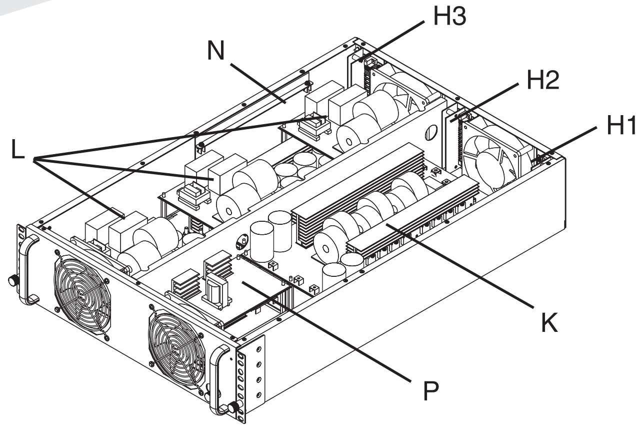


*Fig 1.7.2a*

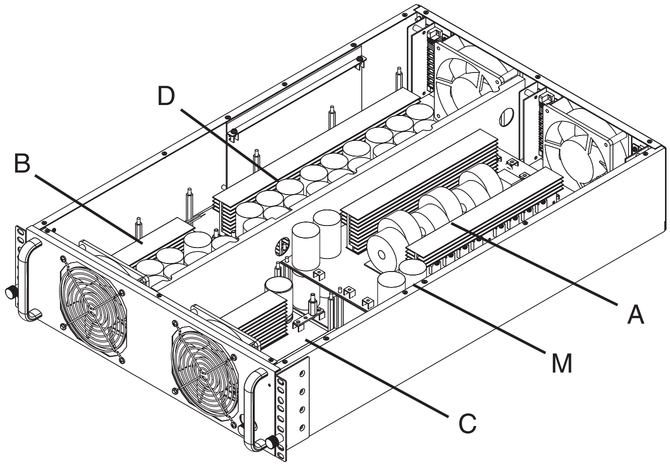


*Fig 1.7.2b*

## 1.8 Block and Wiring Diagrams *(continued)*

### 1.8.1 KX Models

Input: 3-phase 4-wire 230/380Vac
Output: 3-phase 4-wire 230/380Vac

The SU20KX (Figure 1.8.1a) has a model rating of 20kVA UPS and contains one power module and 40 internal batteries (which can be increased to 80, if necessary). (See Figure 1.8.1b for wiring.)

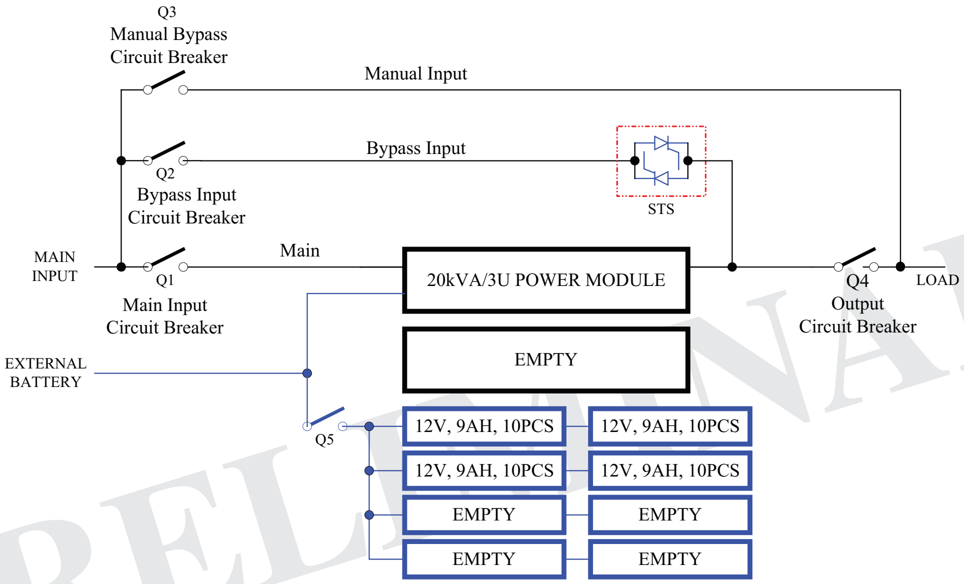

Q3
Manual Bypass
Circuit Breaker
Manual Input
Bypass Input
STS
Q2
Bypass Input
Circuit Breaker
MAIN
INPUT
Main
Q1
Main Input
Circuit Breaker
20kVA/3U POWER MODULE
Q4
Output
Circuit Breaker
LOAD
EXTERNAL
BATTERY
EMPTY
Q5
12V, 9AH, 10PCS
12V, 9AH, 10PCS
12V, 9AH, 10PCS
12V, 9AH, 10PCS
EMPTY
EMPTY
EMPTY
EMPTY

*Fig 1.8.1a SU20KX Block Diagram*

The SU40KX (Figure 1.8.1c) has a model rating of 40kVA UPS and contains two power modules and 80 internal batteries. (See Figure 1.8.1d for wiring.)

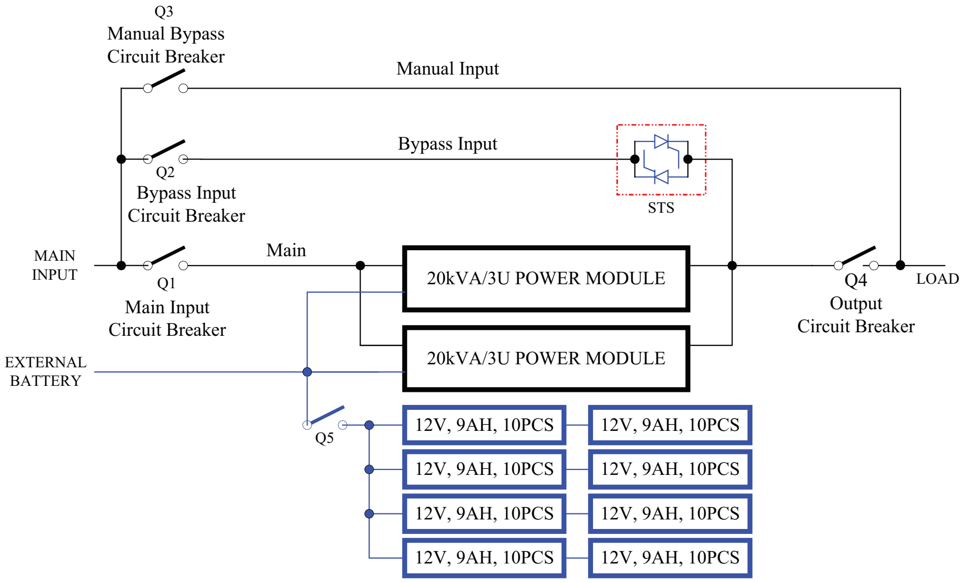
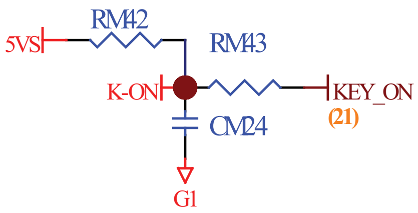
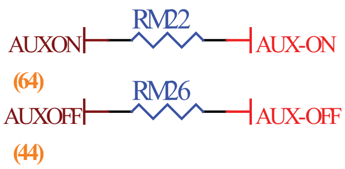

Q3
Manual Bypass
Circuit Breaker
Manual Input
Bypass Input
STS
Q2
Bypass Input
Circuit Breaker
MAIN
INPUT
Main
Q1
Main Input
Circuit Breaker
20kVA/3U POWER MODULE
20kVA/3U POWER MODULE
Q4
Output
Circuit Breaker
LOAD
EXTERNAL
BATTERY
Q5
12V, 9AH, 10PCS
12V, 9AH, 10PCS
12V, 9AH, 10PCS
12V, 9AH, 10PCS
12V, 9AH, 10PCS
12V, 9AH, 10PCS
12V, 9AH, 10PCS
12V, 9AH, 10PCS

*Fig 1.8.1c SU40KX Block Diagram*

## 2.2 DC Auxiliary Power Circuit *(continued)*

Located at NH-SYS-M board (System MCU and Control Circuit)

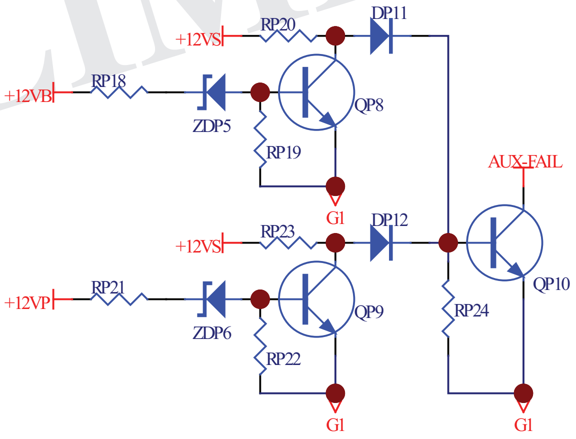

5VS
RM42
RM43
K-ON
KEY_ON
(21)
CM24
G1


RM22
AUXON
AUX-ON
(64)
RM26
AUXOFF
AUX-OFF
(44)

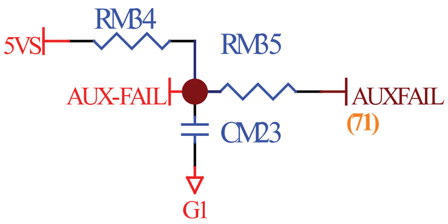
(a) The input of DC auxiliary power circuit is from positive battery.
(b) MCU detects the "on" key (on LCD board) status through KEY-ON(21)
(c) When AC auxiliary power circuit is activated and battery is present, AUXON (64) is high and DC auxiliary power circuit will be on.
(d) If AUXOFF (44) is high during backup mode, DC auxiliary power will be off.

## 2.3 Auxiliary Power Failure Detection

Located at NH-SYS-P board (Auxiliary Power for System, Detect Circuit for Voltage and Current)


+12VS
RP20
DP11
+12VB
RP18
ZDP5
QP8
RP19
G1
AUX-FAIL
+12VS
RP23
DP12
QP10
+12VP
RP21
ZDP6
QP9
RP22
RP24
G1
G1

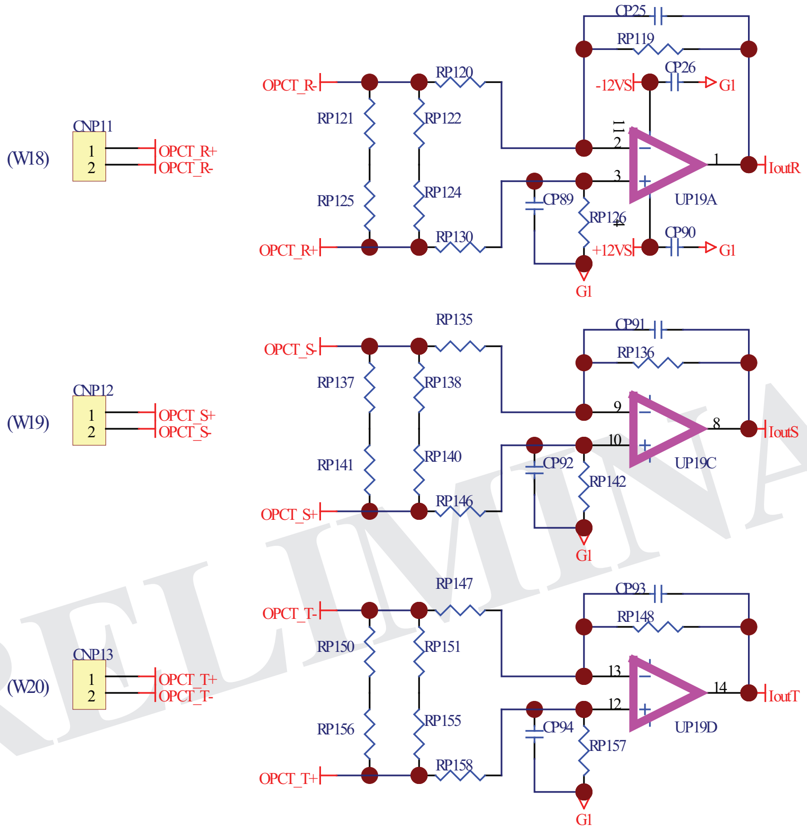
Located at NH-SYS-M board (System MCU and Control Circuit)


5VS
RM34
RM35
AUX-FAIL
AUXFAIL
(71)
CM23
G1

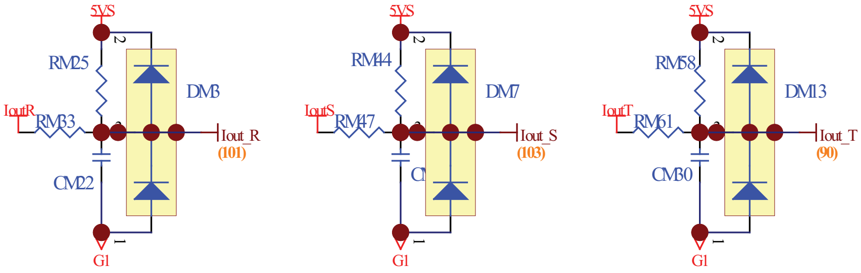
+12VP is from AC auxiliary power and +12VB is from DC auxiliary power. During AC mode, +12VP and +12VB should both be live. If one or both of them fails, MCU can detect auxiliary power failure through AUXFAIL (71) (low active).

## 2.4 Output Current Detection

Located at NH-SYS-P board (Auxiliary Power for System, Detect Circuit for Voltage and Current)


CNP11
(W18)
OPCT_R+
OPCT_R-
RP119
RP120
RP121
RP122
RP124
RP125
RP126
RP130
CP25
CP26
CP89
CP90
-12VS
+12VS
G1
UP19A
IoutR
CNP12
(W19)
OPCT_S+
OPCT_S-
RP135
RP136
RP137
RP138
RP140
RP141
RP142
RP146
CP91
CP92
UP19C
IoutS
CNP13
(W20)
OPCT_T+
OPCT_T-
RP147
RP148
RP150
RP151
RP155
RP156
RP157
RP158
CP93
CP94
UP19D
IoutT

Located at NH-SYS-M board (System MCU and Control Circuit)

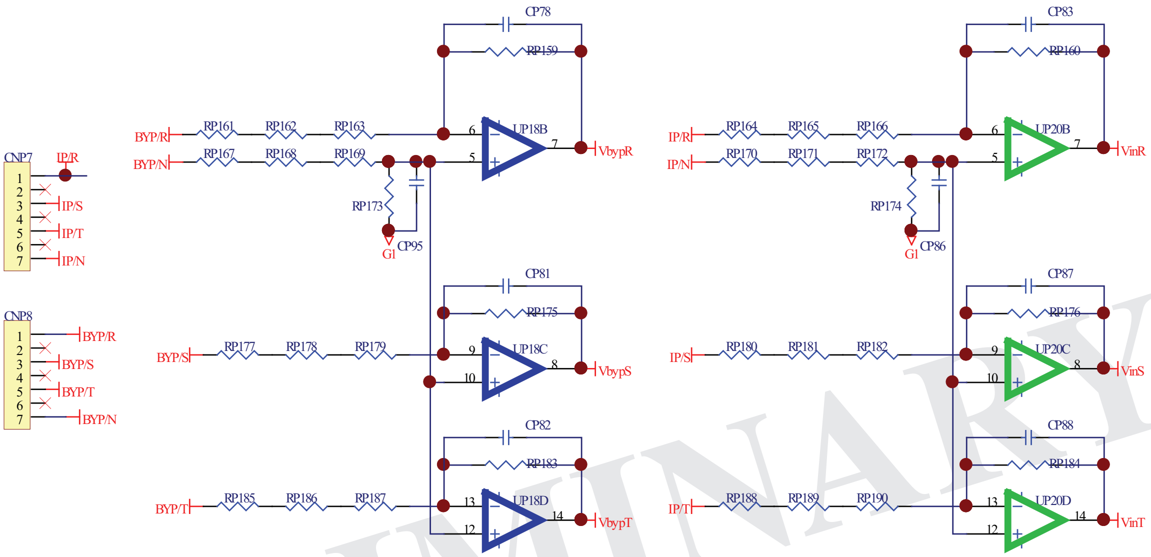

5VS
RM25
IoutR
RM33
CM22
DM3
Iout_R
(101)
G1
RM44
IoutS
RM47
DM7
Iout_S
(103)
RM58
IoutT
RM61
CM30
DM13
Iout_T
(90)

(a) Connectors CNP11, CNP12 and CNP13 connect to 3 Output CT individually.

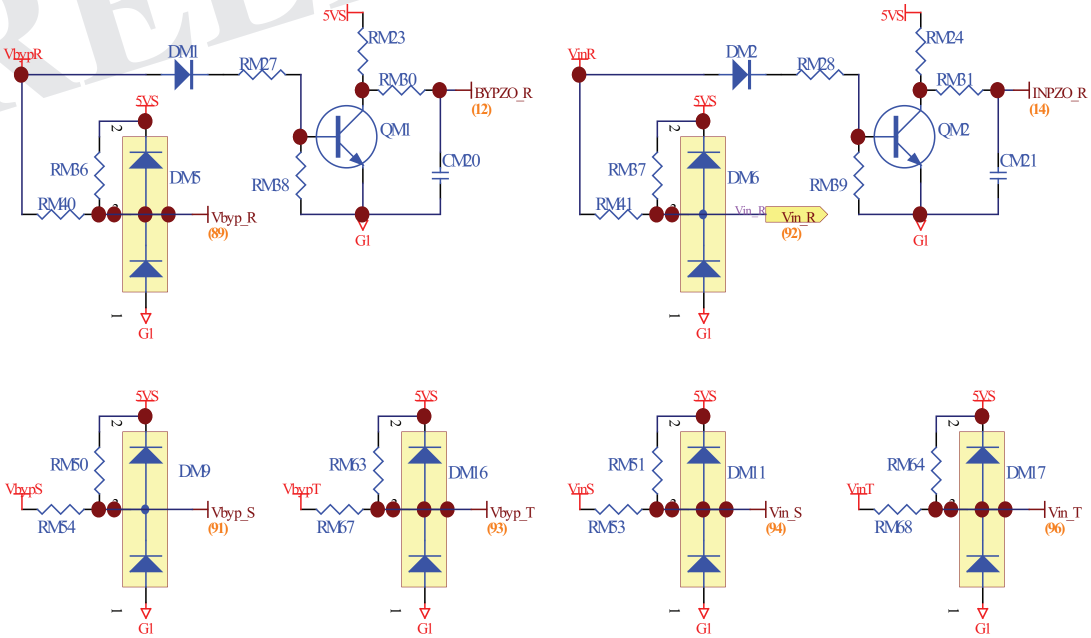
(b) MCU detects 3-phase output currents through Iout_R (101), Iout_S (103) and Iout_T (90). The output current could be bypass current or inverter current, depending on the operation mode.

## 2.5 Input Voltage Detection

Located at NH-SYS-P board (Auxiliary Power for System, Detect Circuit for Voltage and Current)


CNP7
IP/R
IP/S
IP/T
IP/N
CNP8
BYP/R
BYP/S
BYP/T
BYP/N
CP78
RP159
RP161
RP162
RP163
RP167
RP168
RP169
RP173
CP95
UP18B
VbypR
CP81
RP175
RP177
RP178
RP179
UP18C
VbypS
CP82
RP183
RP185
RP186
RP187
UP18D
VbypT
CP83
RP160
RP164
RP165
RP166
RP170
RP171
RP172
RP174
CP86
UP20B
VinR
CP87
RP176
RP180
RP181
RP182
UP20C
VinS
CP88
RP184
RP188
RP189
RP190
UP20D
VinT
GI

Located at NH-SYS-M board (System MCU and Control Circuit)


5VS
VbypR
DM1
RM27
RM23
RM30
BYPZO_R
(12)
QM1
CM20
RM36
DM5
RM38
RM40
Vbyp_R
(89)
GI
VinR
DM2
RM28
RM24
RM31
INPZO_R
(14)
QM2
CM21
RM37
DM6
RM39
RM41
Vin_R
(92)
RM50
DM9
VbypS
RM54
Vbyp_S
(91)
RM63
DM16
VbypT
RM67
Vbyp_T
(93)
RM51
DM11
VinS
RM53
Vin_S
(94)
RM64
DM17
VinT
RM68
Vin_T
(96)

(a) MCU detects RMS value of bypass 3-phase voltage via Vbyp_R (89), Vbyp_S (91) and Vbyp_T (93).

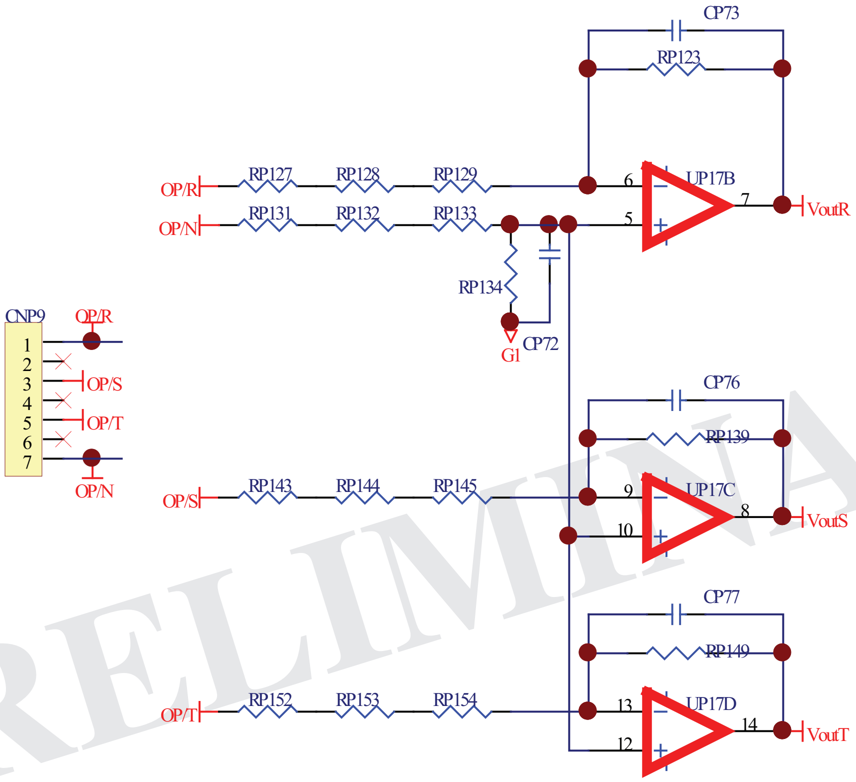
(b) MCU detects RMS value of main input 3-phase voltage via Vin_R (92), Vin_S (94) and Vin_T (96).

(c) MCU detects the bypass frequency and zero crossing via BYPZO_R (12) at falling edge.

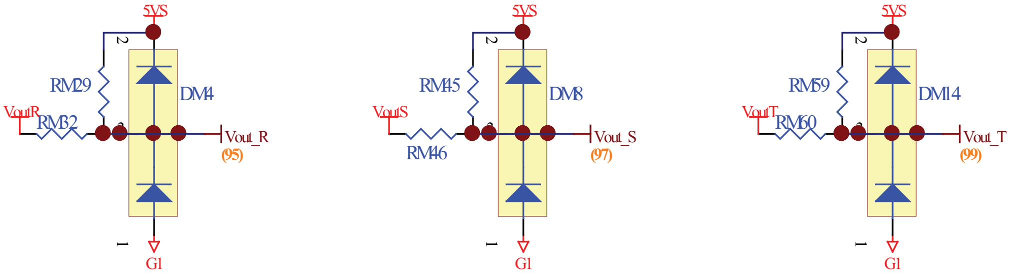
(d) MCU detects the main input frequency and zero crossing via INPZO_R (14) at falling edge.

## 2.6 Output Voltage Detection

Located at NH-SYS-P board (Auxiliary Power for System, Detect Circuit for Voltage and Current)


CP73
RP123
OP/R
RP127
RP128
RP129
6
UP17B
7
VoutR
OP/N
RP131
RP132
RP133
5
RP134
CP72
G1
CNP9
OP/R
1
2
3
4
5
6
7
OP/S
OP/T
OP/N
CP76
RP139
OP/S
RP143
RP144
RP145
9
UP17C
8
VoutS
10
CP77
RP149
OP/T
RP152
RP153
RP154
13
UP17D
14
VoutT
12

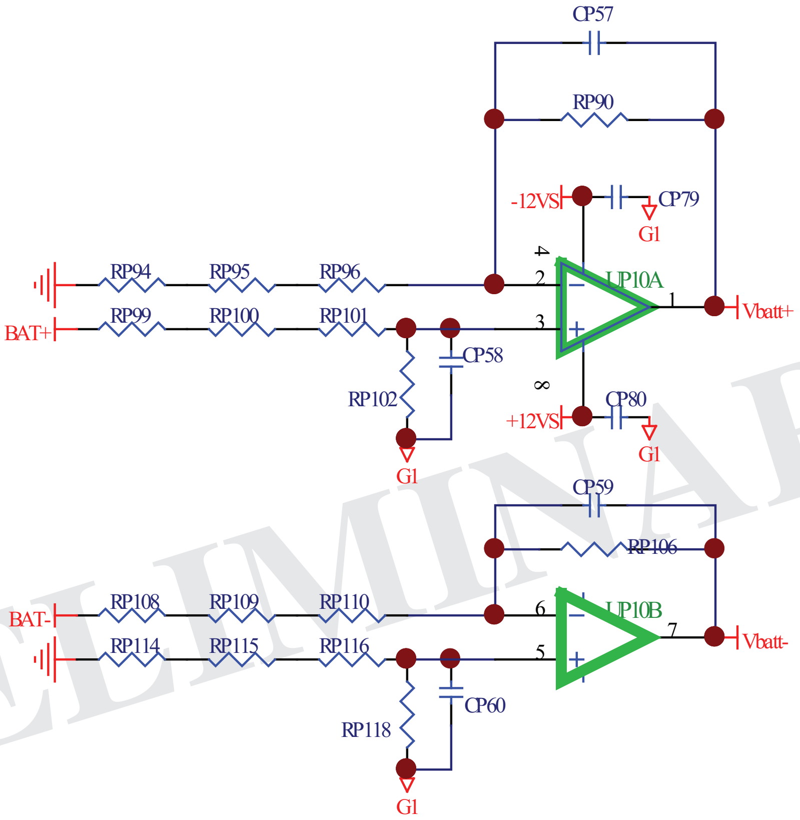
Located at NH-SYS-M board (System MCU and Control Circuit)


5VS
2
RM29
DM4
VoutR
RM32
3
Vout_R
(95)
1
G1
5VS
2
RM45
DM8
VoutS
RM46
3
Vout_S
(97)
1
G1
5VS
2
RM59
DM14
VoutT
RM60
3
Vout_T
(99)
1
G1

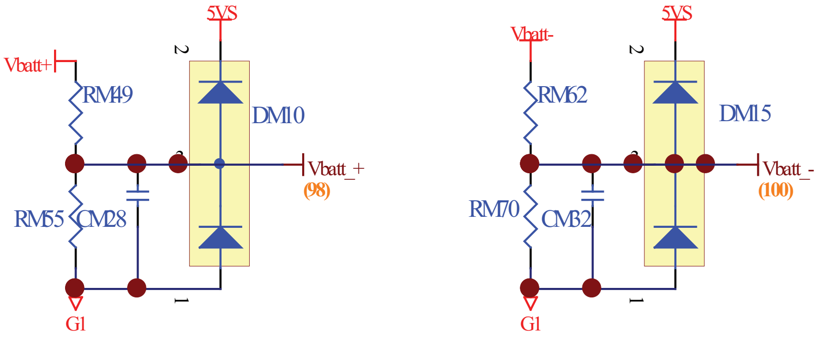
(a) MCU detects RMS value of 3-phase output voltage via Vout_R (95), Vout_S (97) and Vout_T (99).

## 2.7 Battery Voltage Detection

Located at NH-SYS-P board (Auxiliary Power for System, Detect Circuit for Voltage and Current)


CP57
RP90
-12VS
CP79
G1
4
RP94
RP95
RP96
2
UP10A
1
Vbatt+
BAT+
RP99
RP100
RP101
3
CP58
8
RP102
+12VS
CP80
G1
G1
CP59
RP106
BAT-
RP108
RP109
RP110
6
UP10B
7
Vbatt-
RP114
RP115
RP116
5
CP60
RP118
G1

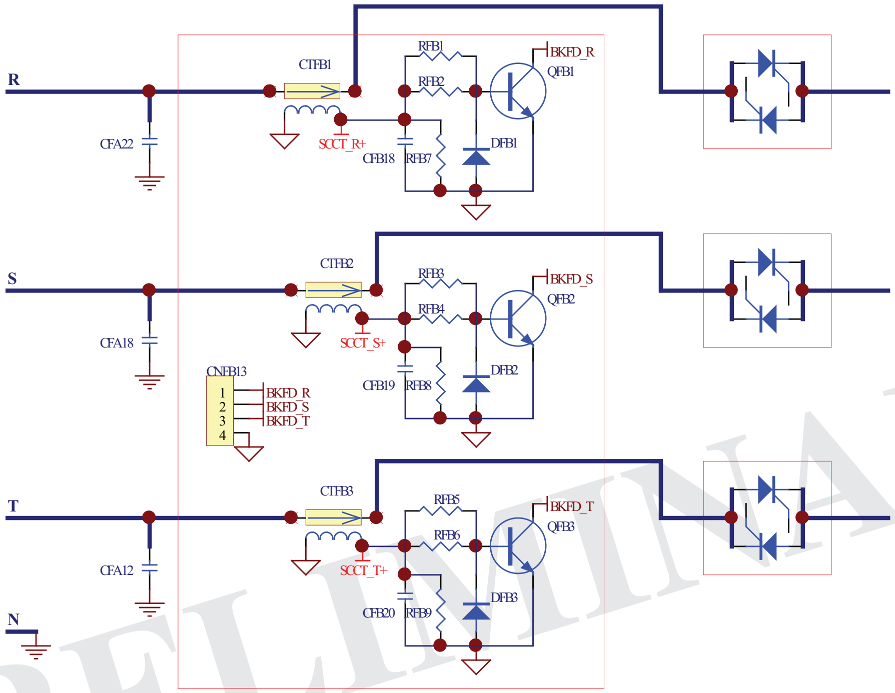
Located at NH-SYS-M board (System MCU and Control Circuit)


5VS
2
Vbatt+
RM49
DM10
3
Vbatt_+
(98)
RM55
CM28
1
G1
Vbatt-
5VS
2
RM62
DM15
3
Vbatt_-
(100)
RM70
CM32
1
G1

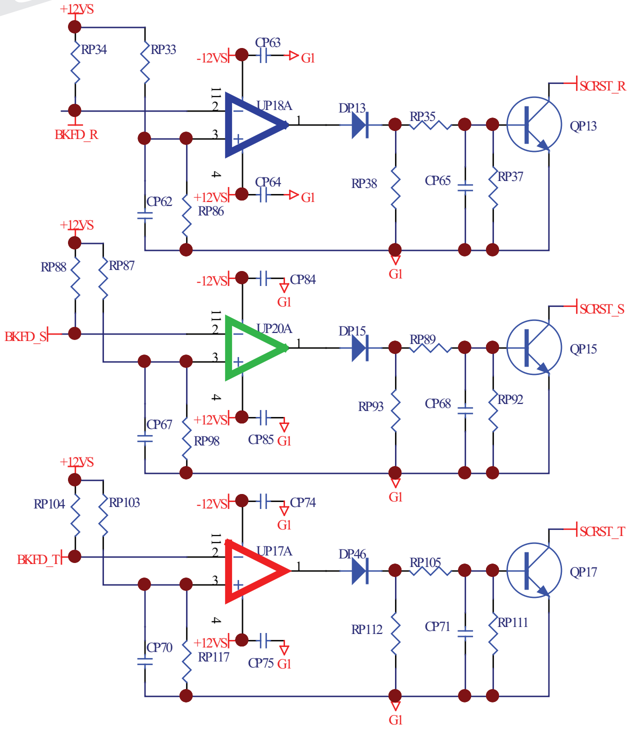
(a) MCU detects battery voltage via Vbatt_+ (98) and Vbatt_- (100).

## 2.8 Bypass SCR Short-Circuit Detection

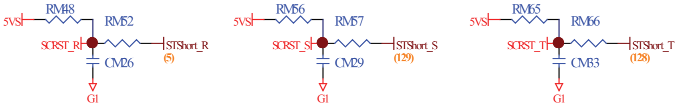
Located at NH-SYS-FB board (Circuit for Bypass Back-Feed Detect)


R
S
T
N
CTFB1
CTFB2
CTFB3
RFB1
RFB2
RFB3
RFB4
RFB5
RFB6
RFB7
RFB8
RFB9
BKFD_R
BKFD_S
BKFD_T
QFB1
QFB2
QFB3
SCCT_R+
SCCT_S+
SCCT_T+
CFB18
CFB19
CFB20
DFB1
DFB2
DFB3
CFA22
CFA18
CFA12
CNFB13
1
2
3
4
BKFD_R
BKFD_S
BKFD_T

Located at NH-SYS-P board (Auxiliary Power for System, Detect Circuit for Voltage and Current)


+12VS
RP34
RP33
-12VS
CP63
GI
UP18A
BKFD_R
DP13
RP35
SCRST_R
QP13
CP64
+12VS
RP86
CP62
RP38
CP65
RP37
GI
+12VS
RP88
RP87
-12VS
CP84
GI
UP20A
BKFD_S
DP15
RP89
SCRST_S
QP15
RP93
CP68
RP92
CP67
+12VS
RP98
CP85
GI
+12VS
RP104
RP103
-12VS
CP74
GI
UP17A
BKFD_T
DP46
RP105
SCRST_T
QP17
RP112
CP71
RP111
CP70
+12VS
RP117
CP75
GI
11
2
3
4
1

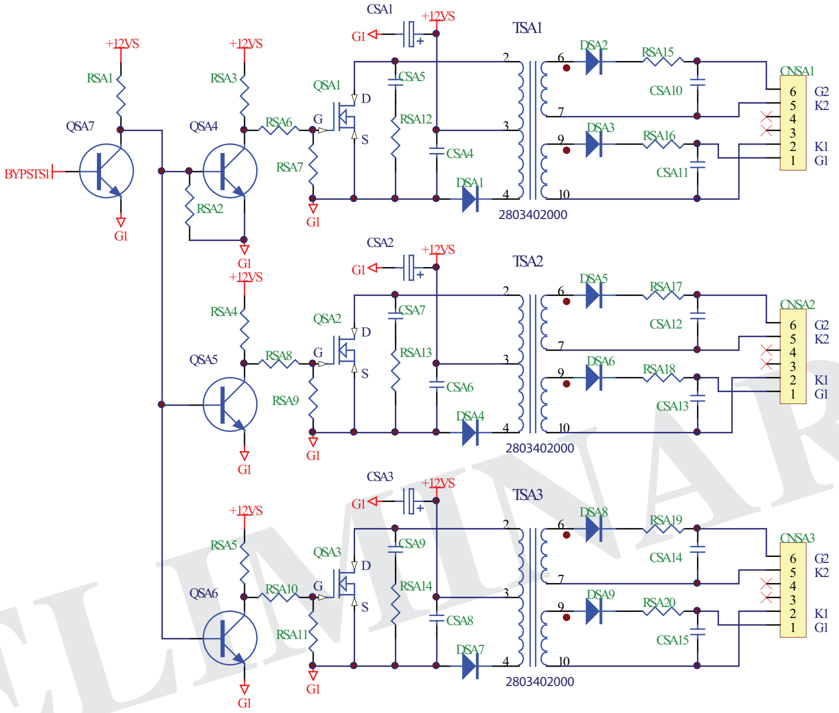
Located at NH-SYS-M board (System MCU and Control Circuit)


5VS
RM48
RM52
SCRST_R
STShort_R
(5)
CM26
GI
5VS
RM56
RM57
SCRST_S
STShort_S
(129)
CM29
GI
5VS
RM65
RM66
SCRST_T
STShort_T
(128)
CM33
GI

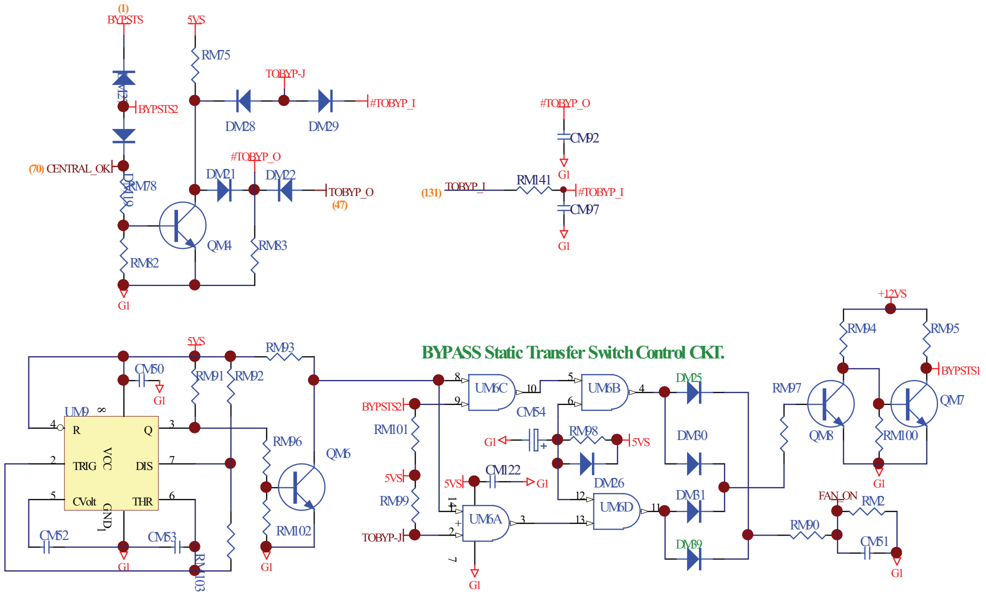
(a) During backup mode, bypass 3 SCRs should be off and zero current should be running through CTFB1, CTFB2 and CTFB3. If current is running through CTFB1, CTFB2 or CTFB3, then STShort_R (5), STShort_S (129) or STShort_T (128) will be low. The UPS will turn off its inverter to prevent back-feed voltage.

## 2.9 Bypass SCR Driver

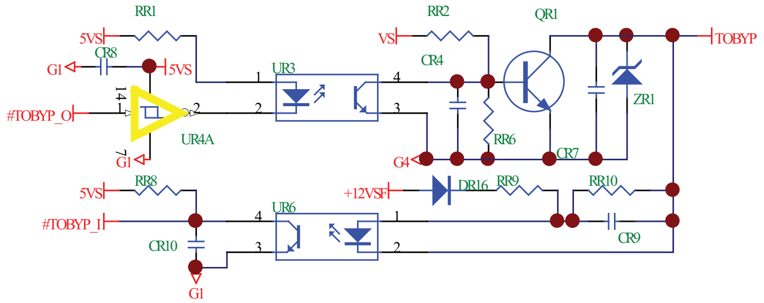
Located at NH-SYS-S or NH-SYS-SA board (Driver Circuit for Bypass SCR)


CSA1
+12VS
G1
TSA1
+12VS
RSA1
QSA7
BYPSTS1
RSA3
QSA4
RSA6
RSA2
RSA7
QSA1
D
G
S
CSA5
RSA12
CSA4
DSA1
2803402000
DSA2
RSA15
CSA10
DSA3
RSA16
CSA11
CNSA1
G2
K2
K1
G1
CSA2
TSA2
RSA4
QSA5
RSA8
RSA9
QSA2
CSA7
RSA13
CSA6
DSA4
DSA5
RSA17
CSA12
DSA6
RSA18
CSA13
CNSA2
CSA3
TSA3
RSA5
QSA6
RSA10
RSA11
QSA3
CSA9
RSA14
CSA8
DSA7
DSA8
RSA19
CSA14
DSA9
RSA20
CSA15
CNSA3

Located at NH-SYS-M board (System MCU and Control Circuit)


(1) BYPSTS
5VS
RM75
TOBYP-J
DM28
DM29
#TOBYP_I
BYPSTS2
(70) CENTRAL_OK
RM78
#TOBYP_O
DM21
DM22
TOBYP_O
(47)
QM4
RM83
RM82
G1
#TOBYP_O
CM92
(131) TOBYP_I
RM141
#TOBYP_I
CM97
+12VS
RM94
RM95
BYPSTS1
QM7
5VS
RM93
CM50
RM91
RM92
BYPASS Static Transfer Switch Control CKT.
UM9
R
Q
TRIG
DIS
CVolt
THR
VCC
GND
RM96
QM6
RM102
CM52
CM53
RM103
UM6C
UM6B
UM6A
UM6D
BYPSTS2
RM101
CM54
RM98
5VS
5VS
RM99
CM122
TOBYP-J
DM25
DM30
DM26
DM31
DM39
RM97
QM8
RM100
FAN_ON
RM2
RM90
CM51

Located at NH-SYS-R board (Circuit for RS232, Output Dry Contact, Parallel Port, Connector to connect with each Power Module, Circuit for 2 Slots)


RR1
5VS
CR8
G1
5VS
#TOBYP_O
UR4A
UR3
RR2
VS
CR4
QR1
RR6
G4
CR7
ZR1
TOBYP
RR8
5VS
#TOBYP_I
CR10
G1
UR6
+12VSI
DR16
RR9
RR10
CR9

## 2.9 Bypass SCR Driver *(continued)*

(a) The bypass SCR driver signal “BYPSTS1” is controlled by MCU or “TOBYP_J” according to the signal “CENTRAL_OK.”

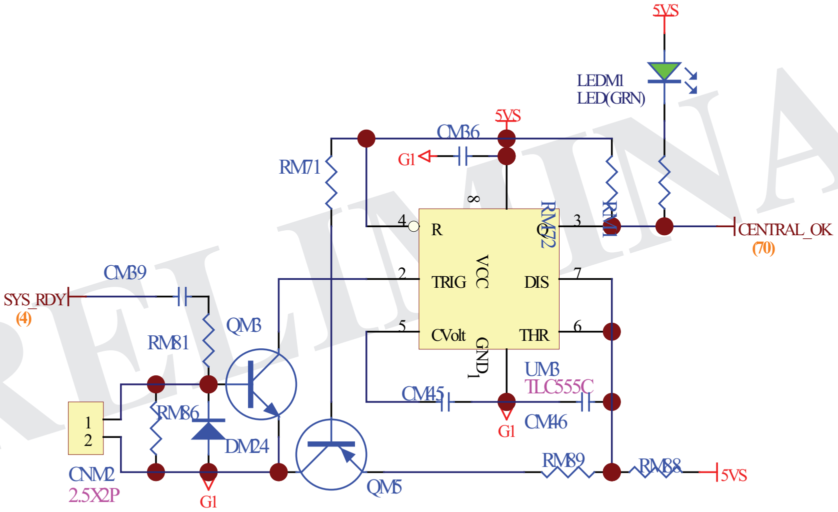
(b) “CENTRAL_OK” is the output of MCU watchdog. If MCU is operating normally, “CENTRAL_OK” will be high and the bypass SCR driver signal will be controlled by “BYPSTS” (1) (high active). If MCU is not operating normally, “CENTRAL_OK” will be low and the bypass SCR driver signal will be controlled by “TOBYP_J” (high active).

(c) UM9 is a 45 kHz self-oscillator that can provide pulse signal for driver bypass SCR.

(d) The “TOBYP_J” signal is limited by “#TOBYP_I.”

## 2.10 Watchdog for System MCU

Located at NH-SYS-M board (System MCU and Control Circuit)

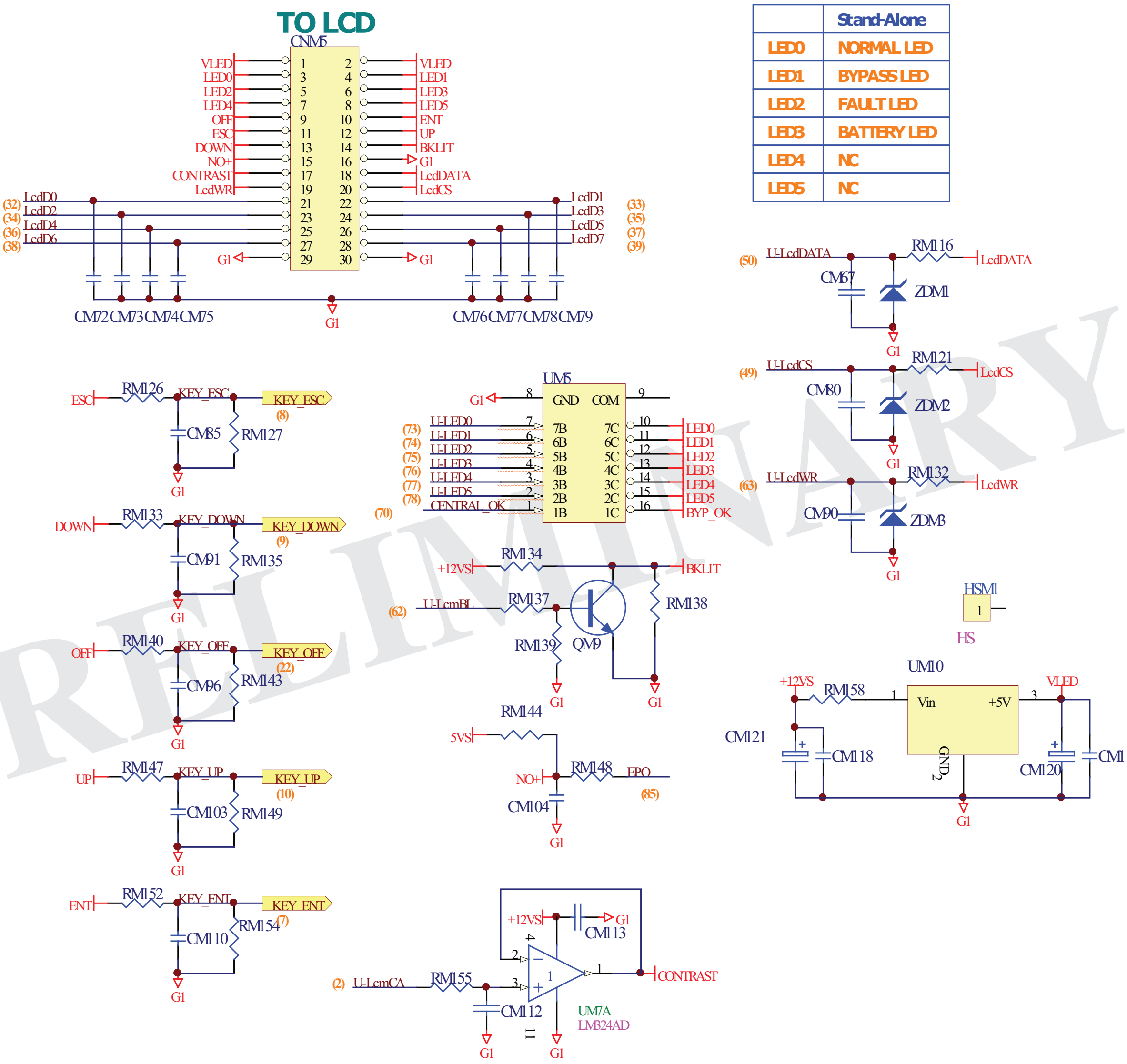

5VS
LEDM1
LED(GRN)
5VS
CM36
G1
RM71
8
RM72
RM1
4
R
Q
3
CENTRAL_OK
(70)
VCC
CM39
SYS_RDY
(4)
2
TRIG
DIS
7
QM3
5
CVolt
THR
6
RM81
GND
UM8
TLC555C
CM45
RM86
1
2
DM24
G1
CM46
RM89
RM88
5VS
CNM2
2.5X2P
G1
QM5

(a) SYS_RDY (4) will send out a pulse to reset CM46. CM46 will then be recharged by 5V through RM88. “CENTRAL_OK” will maintain a high level. If SYS_RDY (4) does not send out a pulse during a specific period (for example, during an MCU crash), then “CENTRAL_OK” will be low.

(b) Test JUMP (CNM2): If CNM2 is shorted, then “CENTRAL_OK” will be low. If CNM2 is opened, “CENTRAL_OK” will stay high during normal operation.

## 2.11 LCD Panel Control Circuit

Located at NH-SYS-M board (System MCU and Control Circuit)


TO LCD
CNM5
VLED
LED0
LED2
LED4
OFF
ESC
DOWN
NO+
CONTRAST
LcdWR
VLED
LED1
LED3
LED5
ENT
UP
BKLIT
GI
LcdDATA
LcdCS
LcdD0
LcdD2
LcdD4
LcdD6
LcdD1
LcdD3
LcdD5
LcdD7
CM72 CM73 CM74 CM75
CM76 CM77 CM78 CM79
U-LcdDATA
RM116
CM67
ZDM1
U-LcdCS
RM121
CM80
ZDM2
U-LcdWR
RM132
CM90
ZDM3
RM126
KEY_ESC
CM85
RM127
RM133
KEY_DOWN
CM91
RM135
RM140
KEY_OFF
CM96
RM143
RM147
KEY_UP
CM103
RM149
RM152
KEY_ENT
CM110
RM154
UM5
GND
COM
U-LED0
U-LED1
U-LED2
U-LED3
U-LED4
U-LED5
CENTRAL_OK
BYP_OK
+12VS
RM134
U-LcmBL
RM137
RM138
RM139
QM9
5VS
RM144
RM148
EPO
CM104
HSM1
HS
UM10
Vin
+5V
GND
RM158
CM121
CM118
CM120
CM119
U-LcmCA
RM155
CM112
CM113
UM7A
LM324AD

| | Stand-Alone |
|---|---|
| LED0 | NORMAL LED |
| LED1 | BYPASS LED |
| LED2 | FAULT LED |
| LED3 | BATTERY LED |
| LED4 | NC |
| LED5 | NC |

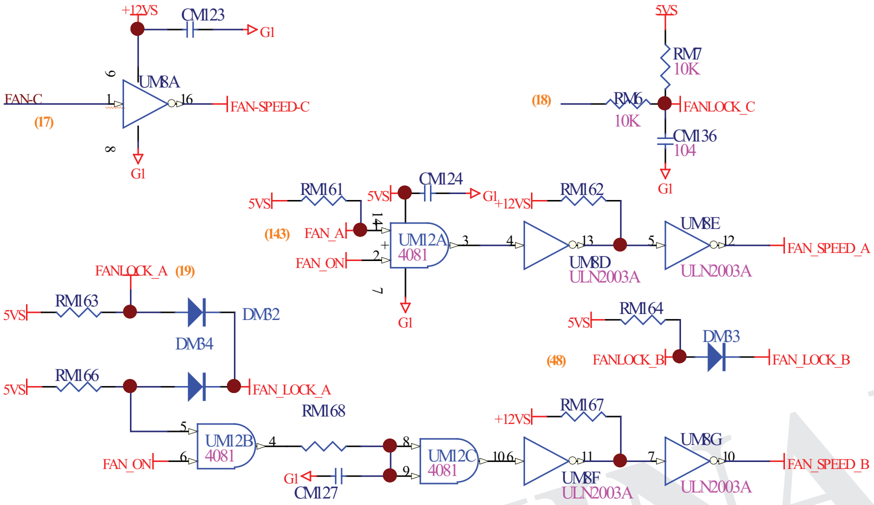
(a) MCU detects the status of EPO button (on LCD display panel) via “EPO” (85) (low active). When the EPO button is activated, UPS will shut down the output and turn off the inverter. When the EPO button is released, UPS will stay in bypass mode.

(b) MCU can control the LCD backlight via “U-lcmBL” (62).

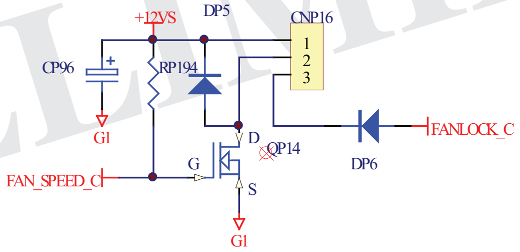
(c) MCU can adjust the contrast of LCD by PWM control via “U-lcmCA” (2).

## 2.12 Fan Control Circuit

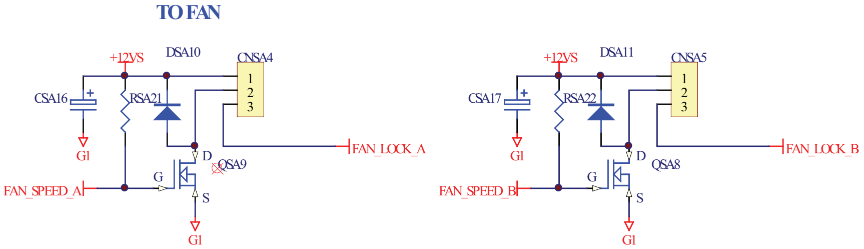
Located on NH-SYS-M board (System MCU and Control Circuit)


+12VS
CM123
G1
UM8A
9
8
FAN-C
(17)
1
16
FAN-SPEED-C
G1
5VS
RM7
10K
(18)
RM6
10K
FANLOCK_C
CM136
104
G1
5VS
RM161
5VS
CM124
G1
+12VS
RM162
(143)
FAN_A
FAN_ON
14
UM12A
4081
3
7
G1
4
13
UM8D
ULN2003A
5
UM8E
12
ULN2003A
FAN_SPEED_A
FANLOCK_A (19)
5VS
RM163
DM32
DM34
5VS
RM166
FAN_LOCK_A
5VS
RM164
DM33
(48)
FANLOCK_B
FAN_LOCK_B
RM168
5
6
FAN_ON
UM12B
4081
4
8
9
G1
CM127
UM12C
4081
10
6
+12VS
RM167
11
UM8F
ULN2003A
7
UM8G
10
ULN2003A
FAN_SPEED_B

Located on NH-SYS-P board (Auxiliary Power for System, Detect Circuit for Voltage and Current)


+12VS
DP5
CNP16
1
2
3
CP96
RP194
G1
D
QP14
G
S
FAN_SPEED_C
G1
FANLOCK_C
DP6

Located on NH-SYS-S or NH-SYS-SA board (Driver Circuit for Bypass SCR)


TO FAN
+12VS
DSA10
CNSA4
1
2
3
CSA16
RSA21
G1
D
QSA9
G
S
FAN_SPEED_A
G1
FAN_LOCK_A
+12VS
DSA11
CNSA5
1
2
3
CSA17
RSA22
G1
D
QSA8
G
S
FAN_SPEED_B
G1
FAN_LOCK_B

(a) Fan C is located at the rear panel of the power module's input EMI filter. Fan A and Fan B are both located at the heat-sink for bypass SCR.

(b) MCU controls fan C via FAN-C (17).

(c) MCU detects a fan C failure via (18).

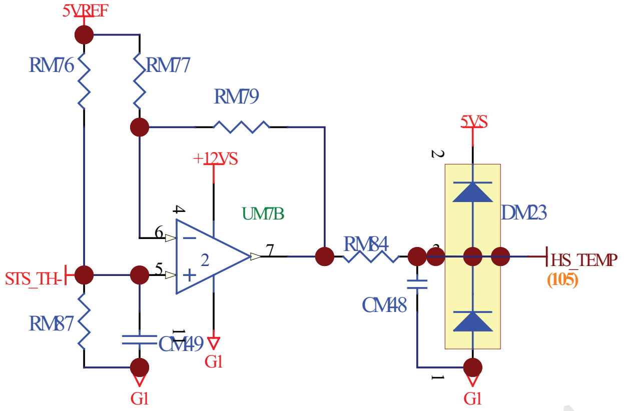
(d) When in bypass mode, FAN_A (143) will be high to control fan A; fan B will be off. If fan A experiences a failure, fan B will turn on.

(e) MCU detects a fan A failure via FANLOCK_A (19).

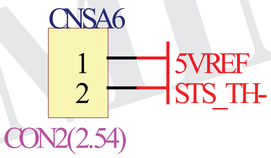
(f) MCU detects a fan B failure via FANLOCK_B (48).

## 2.13 Bypass SCR Temperature Detection

Located on NH-SYS-M board (System MCU and Control Circuit)


5VREF
RM76
RM77
RM79
+12VS
UM7B
STS_TH-
RM87
CM49
G1
RM84
CM48
5VS
DM23
HS_TEMP
(105)
G1

Located on NH-SYS-S or NH-SYS-SA board (Driver Circuit for Bypass SCR)

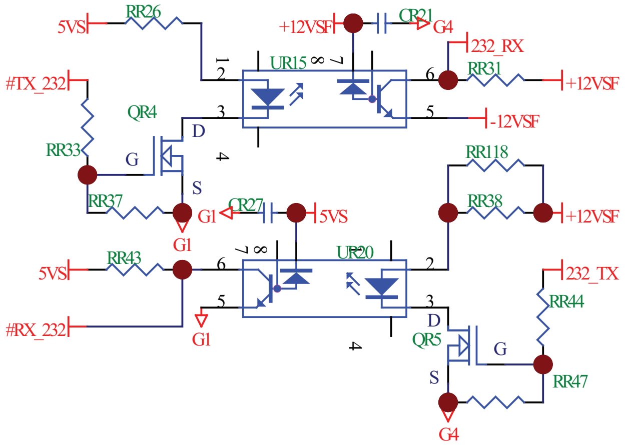

CNSA6
1
2
5VREF
STS_TH-
CON2(2.54)

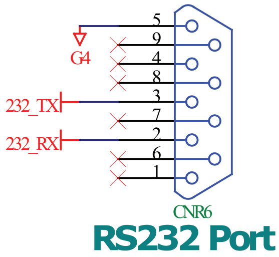
(a) Temperature sensor (NTC) is screwed onto the heat-sink of bypass SCR and connected to CNSA6 on the NH-SYS-S or SA board.

(b) MCU detects the temperature via HS_TEMP (105).

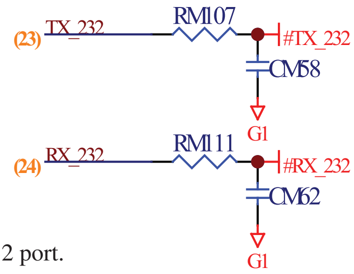
## 2.14 Communication Circuit for RS232

Located on NH-SYS-R board (Circuit for RS232, Output Dry Contact, Parallel Port, Connector to connect with each Power Module, Circuit for 2 Slots)


5VS
RR26
+12VSF
CR21
G4
232_RX
#TX_232
UR15
RR31
+12VSF
QR4
-12VSF
RR33
RR118
RR37
G1
CR27
5VS
RR38
+12VSF
5VS
RR43
UR20
232_TX
RR44
#RX_232
G1
QR5
RR47
G4


G4
232_TX
232_RX
CNR6
RS232 Port

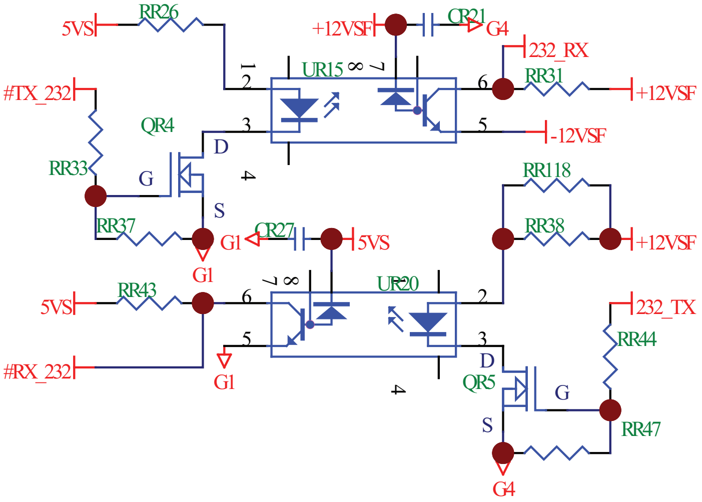
Located on NH-SYS-M board (System MCU and Control Circuit)

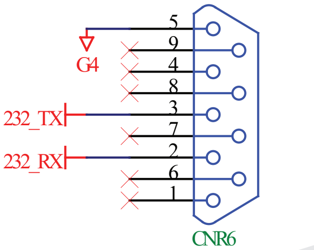

(23)
TX_232
RM107
#TX_232
CM58
G1
(24)
RX_232
RM111
#RX_232
CM62
G1

(a) System MCU TX_232 (23) transmits data via RS232 port.

(b) System MCU RX_232 (24) receives data via RS232 port.

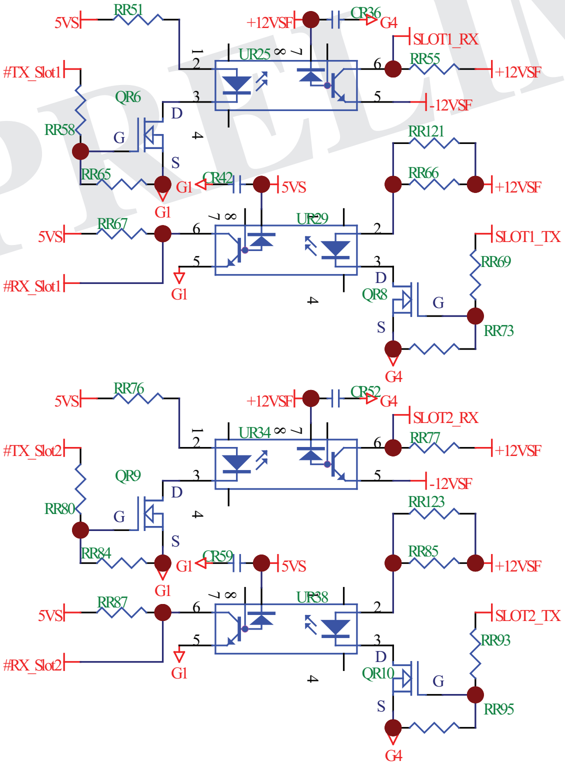
## 2.15 Communication Circuit for Slots


5VS
RR26
+12VSF
CR21
G4
232_RX
UR15
RR31
+12VSF
#TX_232
QR4
-12VSF
RR33
RR118
RR37
G1
CR27
5VS
RR38
+12VSF
RR43
UR20
5VS
232_TX
RR44
#RX_232
G1
QR5
RR47
G4

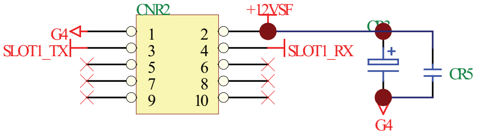

G4
232_TX
232_RX
5
9
4
8
3
7
2
6
1
CNR6

**RS232 Port**

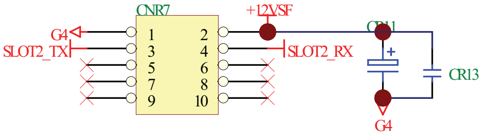
Located on NH-SYS-R board (Circuit for RS232, Output Dry Contact, Parallel Port, Connector to connect with each Power Module, Circuit for 2 Slots)


5VS
RR51
+12VSF
CR36
G4
SLOT1_RX
UR25
RR55
+12VSF
#TX_Slot1
QR6
-12VSF
RR58
RR121
RR65
G1
CR42
5VS
RR66
+12VSF
RR67
UR29
SLOT1_TX
RR69
#RX_Slot1
QR8
RR73
G4
5VS
RR76
+12VSF
CR52
G4
SLOT2_RX
UR34
RR77
+12VSF
#TX_Slot2
QR9
-12VSF
RR80
RR123
RR84
G1
CR59
5VS
RR85
+12VSF
RR87
UR38
SLOT2_TX
RR93
#RX_Slot2
QR10
RR95
G4

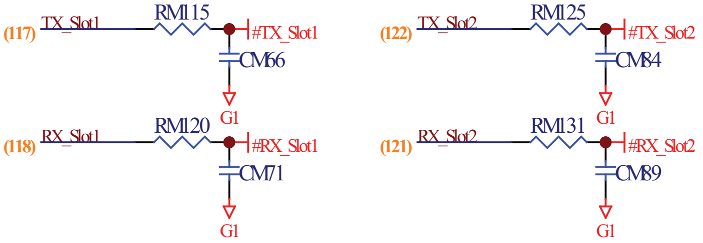
**To Slot 1**


CNR2
+12VSF
G4
SLOT1_TX
SLOT1_RX
CR3
CR5
G4

**To Slot 2**


CNR7
+12VSF
G4
SLOT2_TX
SLOT2_RX
CR11
CR13
G4

Located on NH-SYS-M board (System MCU and Control Circuit)

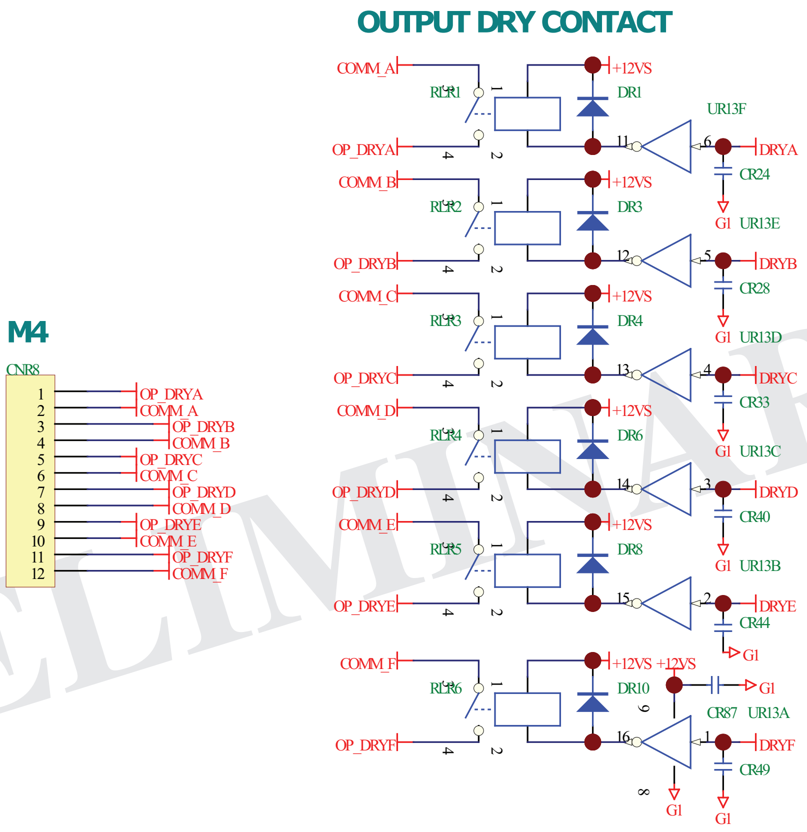

(117)
TX_Slot1
RM115
#TX_Slot1
CM66
G1
(118)
RX_Slot1
RM120
#RX_Slot1
CM71
G1
(122)
TX_Slot2
RM125
#TX_Slot2
CM84
G1
(121)
RX_Slot2
RM131
#RX_Slot2
CM89
G1

(a) System MCU communicates with Slot 1 via TX_Slot1 (117) and RX_Slot1 (118).

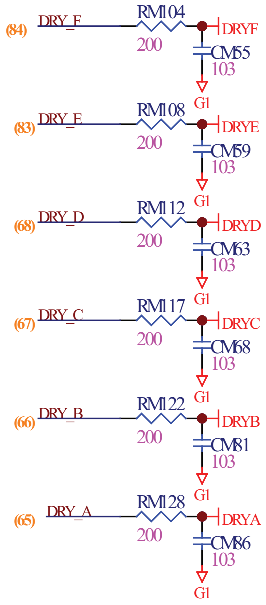
(b) System MCU communicates with Slot2 via TX_Slot2 (122) and RX_Slot2 (121).

## 2.16 Communication Circuit for Output Dry Contact

Located on NH-SYS-R board (Circuit for RS232, Output Dry Contact, Parallel Port, Connector to connect with each Power Module, Circuit for 2 Slots)


OUTPUT DRY CONTACT
M4
CNR8
1 OP_DRYA
2 COMM_A
3 OP_DRYB
4 COMM_B
5 OP_DRYC
6 COMM_C
7 OP_DRYD
8 COMM_D
9 OP_DRYE
10 COMM_E
11 OP_DRYF
12 COMM_F
COMM_A
RLR1
+12VS
DR1
UR13F
OP_DRYA
11
6
DRYA
CR24
GI
UR13E
COMM_B
RLR2
DR3
OP_DRYB
12
5
DRYB
CR28
UR13D
COMM_C
RLR3
DR4
OP_DRYC
13
4
DRYC
CR33
UR13C
COMM_D
RLR4
DR6
OP_DRYD
14
3
DRYD
CR40
UR13B
COMM_E
RLR5
DR8
OP_DRYE
15
2
DRYE
CR44
COMM_F
RLR6
DR10
+12VS
9
CR87
UR13A
OP_DRYF
16
1
DRYF
CR49
8

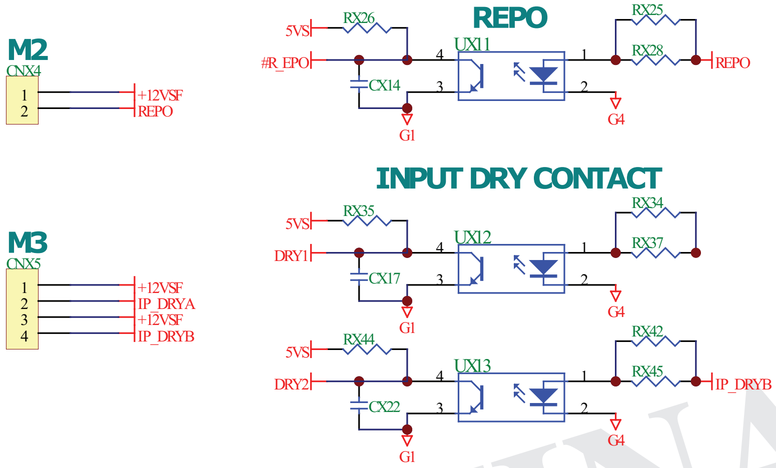
Located on NH-SYS-M board (System MCU and Control Circuit)


(84) DRY_F
RM104
200
DRYF
CM55
103
GI
(83) DRY_E
RM108
200
DRYE
CM59
103
(68) DRY_D
RM112
200
DRYD
CM63
103
(67) DRY_C
RM117
200
DRYC
CM68
103
(66) DRY_B
RM122
200
DRYB
CM81
103
(65) DRY_A
RM128
200
DRYA
CM86
103

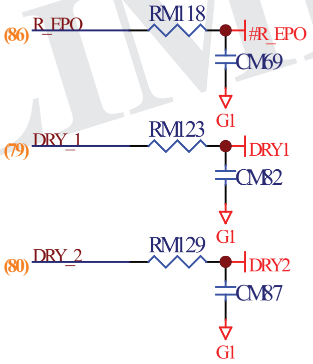
(a) System MCU sends out dry contact signal to the relays via DRY_A (65), DRY_B (66), DRY_C (67), DRY_D (68), DRY_E (83) and DRY_F (84).

## 2.17 Communication Circuit for Input Dry Contact and REPO

Located on NH-SYS-R board (Circuit for RS232, Output Dry Contact, Parallel Port, Connector to connect with each Power Module, Circuit for 2 Slots)


M2
CNX4
1
2
+12VSF
REPO
REPO
5VSF
RX26
#R_EPO
CX14
G1
UX11
4
3
1
2
RX25
RX28
REPO
G4
INPUT DRY CONTACT
M3
CNX5
1
2
3
4
+12VSF
IP_DRYA
+12VSF
IP_DRYB
5VSF
RX35
DRY1
CX17
G1
UX12
RX34
RX37
G4
5VSF
RX44
DRY2
CX22
G1
UX13
RX42
RX45
IP_DRYB
G4

Located on NH-SYS-M board (System MCU and Control Circuit)


(86)
R_EPO
RM118
#R_EPO
CM69
G1
(79)
DRY_1
RM123
DRY1
CM82
G1
(80)
DRY_2
RM129
DRY2
CM87
G1

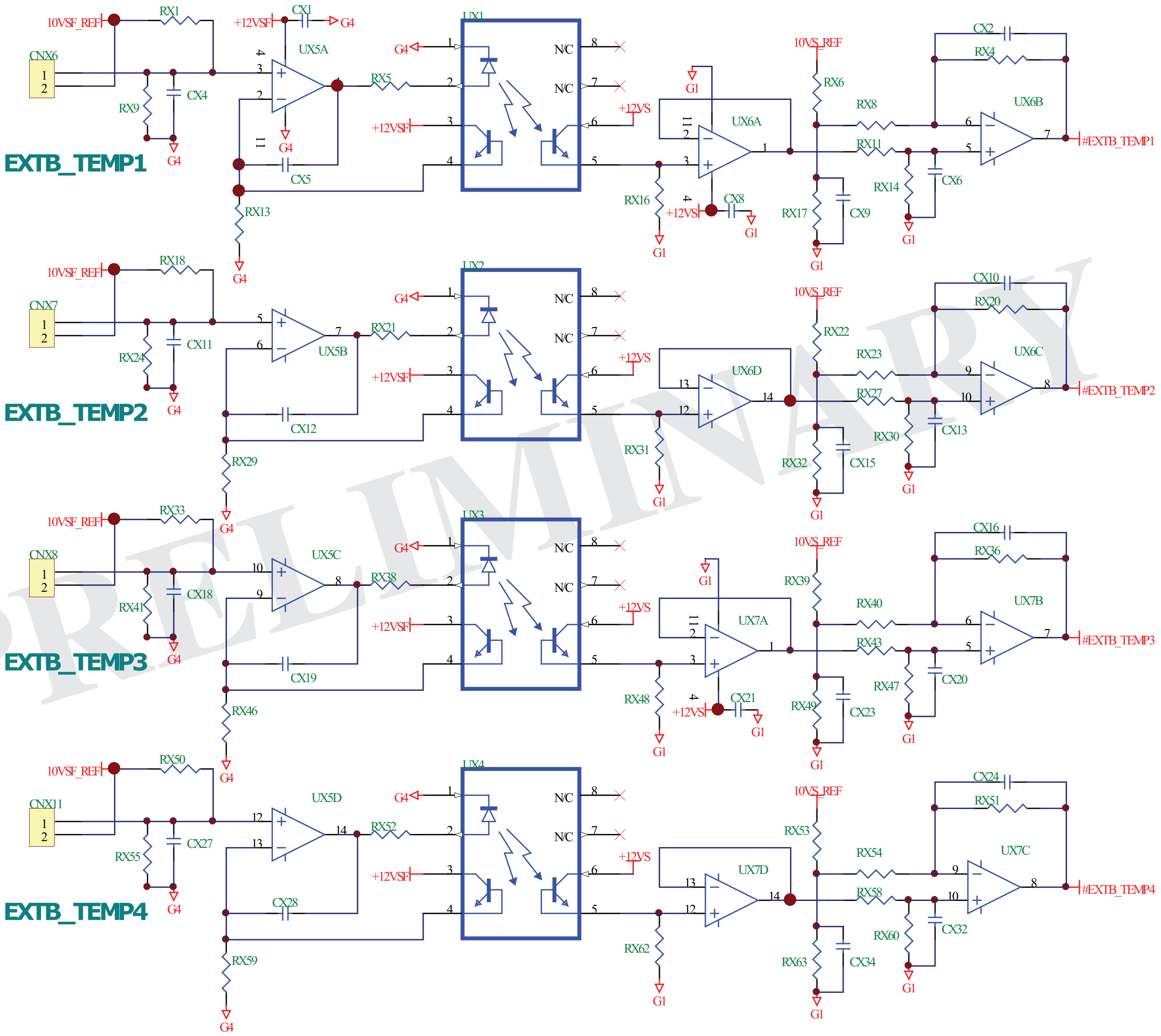
(a) System MCU will detect input dry contact via DRY_1 (79) and DRY_2 (80)

(b) REPO (Remote Emergency Power Off) can be detected via R_EPO (86) by system MCU (high active).

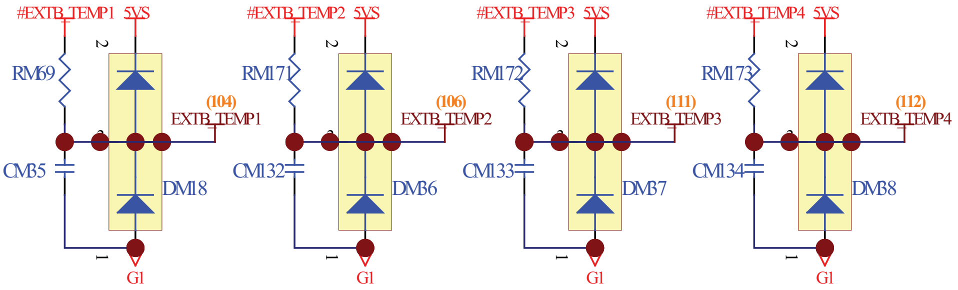
(c) When REPO has activated, System MCU will shut down the output. After the REPO release, the unit will stay in bypass mode.

## 2.18 External Battery Cabinet Temperature Detection

Located on NH-SYS-X board (Circuit for REPO, Input Dry Contact and Circuit for sense External Battery Cabinet Temperature)


10VSF_REF
RX1
+12VSF
CX1
G4
UX1
CNX6
1
2
RX9
CX4
UX5A
RX5
EXTB_TEMP1
CX5
RX13
N/C
10VS_REF
RX6
RX8
RX11
UX6A
UX6B
CX2
RX4
+12VS
RX16
CX8
RX17
CX9
RX14
CX6
G1
#EXTB_TEMP1
RX18
CNX7
RX24
CX11
UX5B
RX21
EXTB_TEMP2
CX12
RX29
UX2
RX22
RX23
RX27
UX6D
UX6C
CX10
RX20
RX31
RX32
CX15
RX30
CX13
#EXTB_TEMP2
RX33
CNX8
RX41
CX18
UX5C
RX38
EXTB_TEMP3
CX19
RX46
UX3
RX39
RX40
RX43
UX7A
UX7B
CX16
RX36
RX48
CX21
RX49
CX23
RX47
CX20
#EXTB_TEMP3
RX50
CNX11
RX55
CX27
UX5D
RX52
EXTB_TEMP4
CX28
RX59
UX4
RX53
RX54
RX58
UX7D
UX7C
CX24
RX51
RX62
RX63
CX34
RX60
CX32
#EXTB_TEMP4

Located on NH-SYS-M board (System MCU and Control Circuit)


#EXTB_TEMP1
5VS
RM69
(104)
EXTB_TEMP1
CM35
DM18
G1
#EXTB_TEMP2
5VS
RM171
(106)
EXTB_TEMP2
CM132
DM36
#EXTB_TEMP3
5VS
RM172
(111)
EXTB_TEMP3
CM133
DM37
#EXTB_TEMP4
5VS
RM173
(112)
EXTB_TEMP4
CM134
DM38

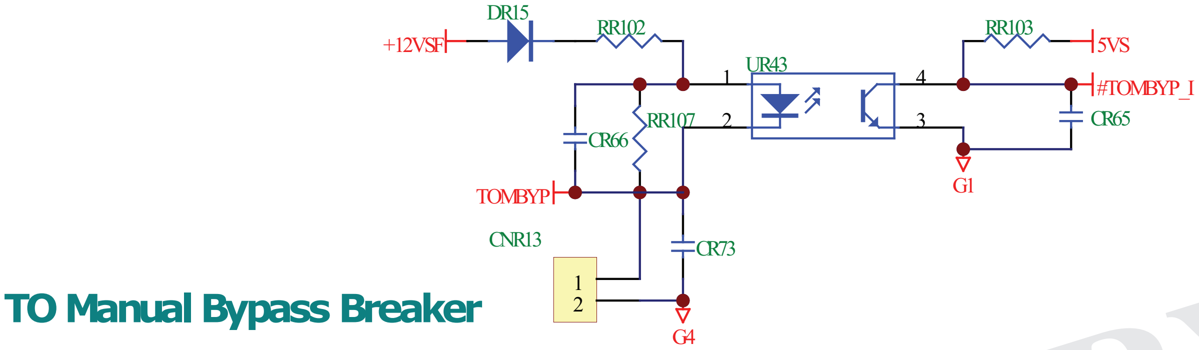
(a) UX1, UX2, UX3 and UX4 are linear photo.

(b) CNX6, CNX7, CNX8 and CNX11 connect the NTC to the external battery cabinet.

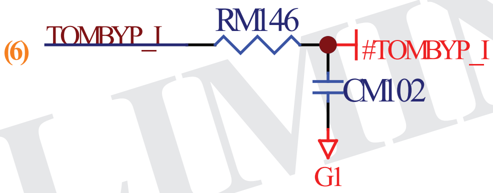
(c) System MCU detects the external battery cabinet temperature via EXTB_TEMP1 (104) for battery cabinet 1, EXTB_TEMP2 (106) for battery cabinet 2, EXTB_TEMP3 (111) for battery cabinet 3, and EXTB_TEMP4 (112) for battery cabinet 4.

## 2.19 Detection Circuit for Manual Bypass Switch

Located on NH-SYS-R board (Circuit for RS232, Output Dry Contact, Parallel Port, Connector to connect with each Power Module, Circuit for 2 Slots)


DR15
+12VSF
RR102
RR103
5VS
UR43
1
2
3
4
#TOMBYP_I
CR65
CR66
RR107
G1
TOMBYP
CNR13
CR73
1
2
G4
TO Manual Bypass Breaker

Located on NH-SYS-M board (System MCU and Control Circuit)

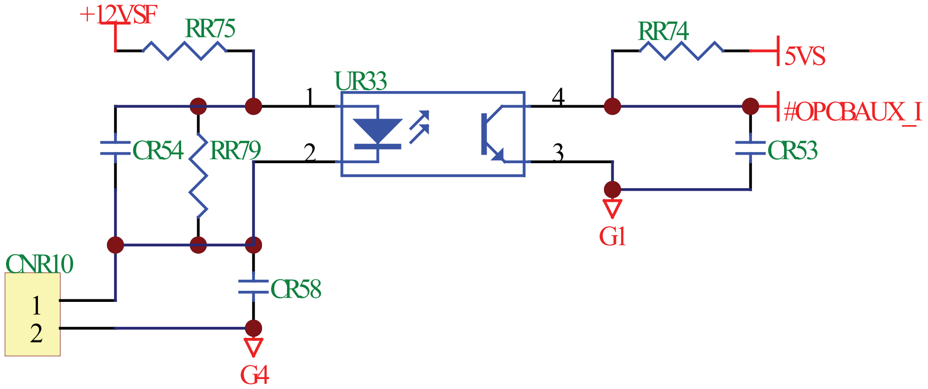

(6)
TOMBYP_I
RM146
#TOMBYP_I
CM102
G1

(a) CNR13 connects to the auxiliary contact of the manual bypass switch.

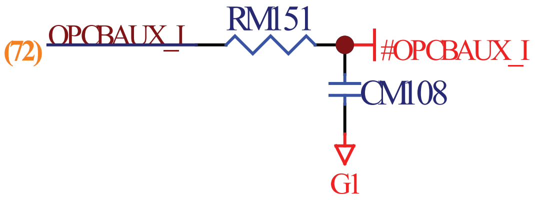
(b) System MCU detects the status of the manual bypass switch via TOMBYP_I (6). Manual bypass switch will stay in the OFF position and TOMBYO_I (6) will be high.

## 2.20 Detection Circuit for Output Breaker

Located on NH-SYS-R board (Circuit for RS232, Output Dry Contact, Parallel Port, Connector to connect with each Power Module, Circuit for 2 Slots)


+12VSF
RR75
RR74
5VS
UR33
1
2
3
4
#OPCBAUX_I
CR54
RR79
CR53
G1
CNR10
1
2
CR58
G4

Located on NH-SYS-M board (System MCU and Control Circuit)

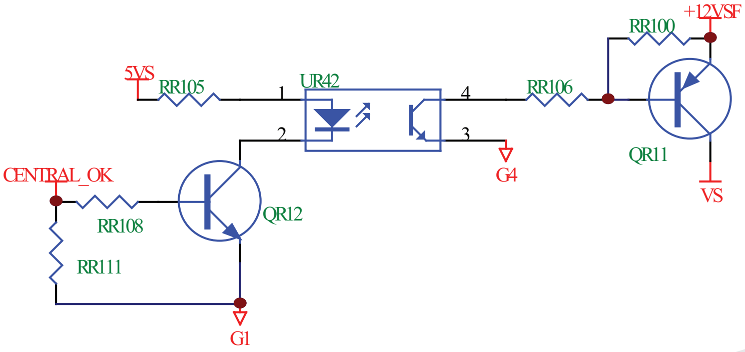

(72)
OPCBAUX_I
RM151
#OPCBAUX_I
CM108
G1

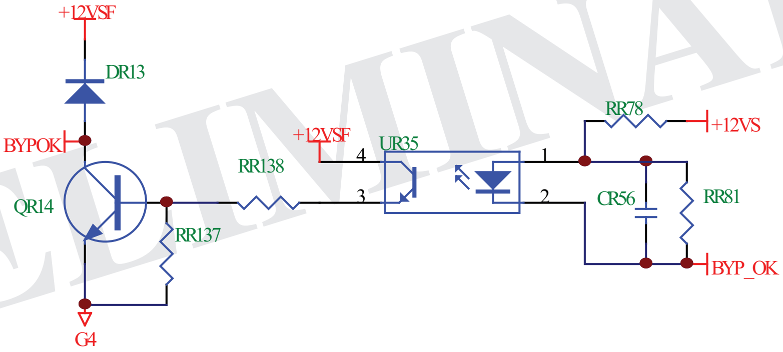
(a) CNR10 connects to the auxiliary contact of the output breaker.

(b) System MCU detects the status of the output breaker via OPCBAUX_I (72). Output breaker stays in the OFF position and OPCBAUX_I (72) will be high.

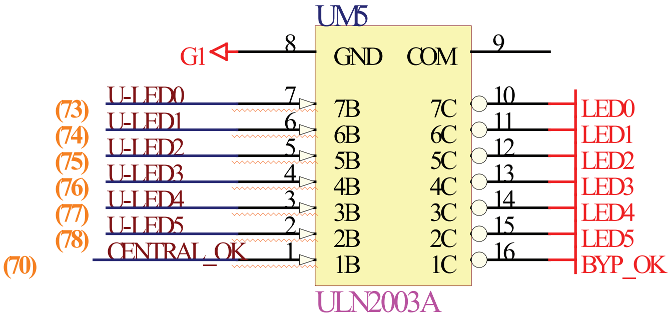
## 2.21 Control Circuit for Power Module

Located on NH-SYS-R board (Circuit for RS232, Output Dry Contact, Parallel Port, Connector to connect with each Power Module, Circuit for 2 Slots)


+12VSF
RR100
5VS
RR105
UR42
1
4
RR106
2
3
G4
QR11
VS
CENTRAL_OK
RR108
QR12
RR111
G1


+12VSF
DR13
RR78
+12VS
BYPOK
+12VSF
UR35
4
1
RR138
QR14
3
2
CR56
RR81
RR137
BYP_OK
G4

Located on NH-SYS-M board (System MCU and Control Circuit)

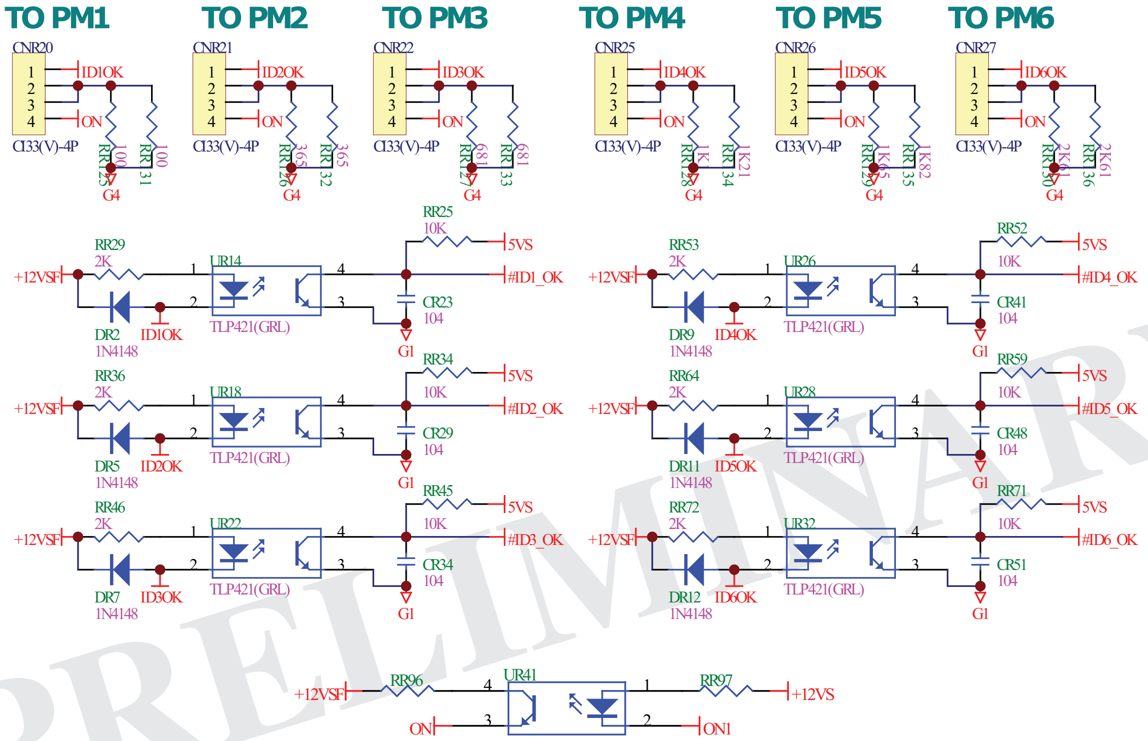

UM5
G1
8
GND
COM
9
(73)
U-LED0
7
7B
7C
10
LED0
(74)
U-LED1
6
6B
6C
11
LED1
(75)
U-LED2
5
5B
5C
12
LED2
(76)
U-LED3
4
4B
4C
13
LED3
(77)
U-LED4
3
3B
3C
14
LED4
(78)
U-LED5
2
2B
2C
15
LED5
(70)
CENTRAL_OK
1
1B
1C
16
BYP_OK
ULN2003A

(a) VS is the voltage source for the parallel signal bus. CENTRAL_OK signal is controlled by the system MCU's watchdog circuit.

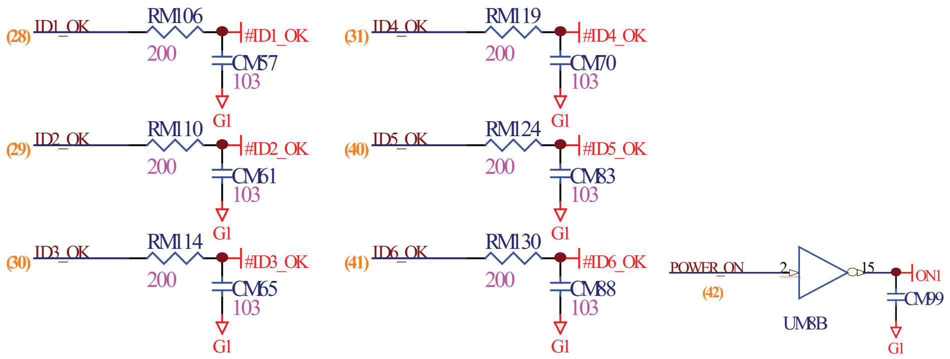
(b) The BYPOK signal indicates that the system MCU is functioning properly.

## 2.21 Control Circuit for Power Module *(continued)*

Located on NH-SYS-R board (Circuit for RS232, Output Dry Contact, Parallel Port, Connector to connect with each Power Module, Circuit for 2 Slots)


TO PM1
TO PM2
TO PM3
TO PM4
TO PM5
TO PM6
CNR20
CNR21
CNR22
CNR25
CNR26
CNR27
CI33(V)-4P
ID1OK
ID2OK
ID3OK
ID4OK
ID5OK
ID6OK
ON
G4
RR125 100
RR131 100
RR126 365
RR132 365
RR127 681
RR133 681
RR128 1K
RR134 1K21
RR129 1K65
RR135 1K82
RR130 2K61
RR136 2K61
+12VSF
5VS
RR29 2K
RR36 2K
RR46 2K
RR53 2K
RR64 2K
RR72 2K
DR2 1N4148
DR5 1N4148
DR7 1N4148
DR9 1N4148
DR11 1N4148
DR12 1N4148
UR14
UR18
UR22
UR26
UR28
UR32
TLP421(GRL)
RR25 10K
RR34 10K
RR45 10K
RR52 10K
RR59 10K
RR71 10K
CR23 104
CR29 104
CR34 104
CR41 104
CR48 104
CR51 104
G1
#ID1_OK
#ID2_OK
#ID3_OK
#ID4_OK
#ID5_OK
#ID6_OK
RR96
UR41
RR97
+12VS
ON
ON1

Located on NH-SYS-M board (System MCU and Control Circuit)

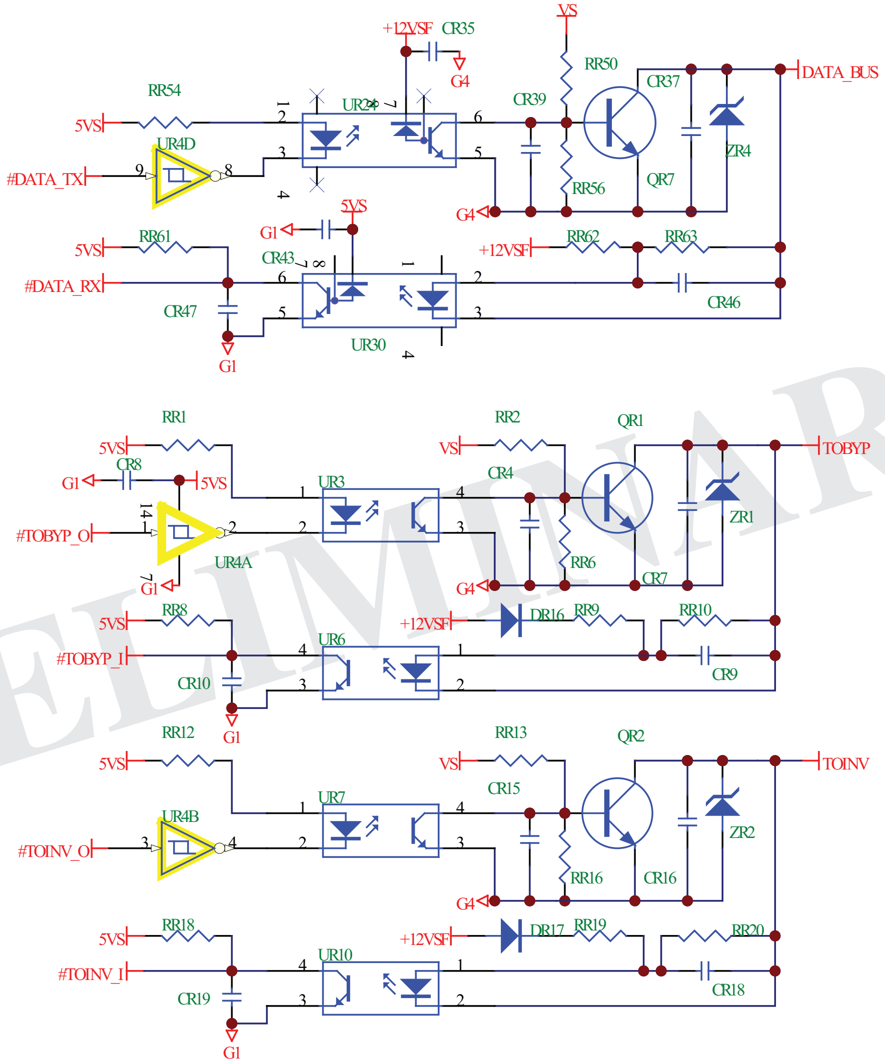

(28) ID1_OK
RM106 200
#ID1_OK
CM57 103
(29) ID2_OK
RM110 200
#ID2_OK
CM61 103
(30) ID3_OK
RM114 200
#ID3_OK
CM65 103
(31) ID4_OK
RM119 200
#ID4_OK
CM70 103
(40) ID5_OK
RM124 200
#ID5_OK
CM83 103
(41) ID6_OK
RM130 200
#ID6_OK
CM88 103
G1
POWER_ON
(42)
UM8B
ON1
CM99

(c) System MCU can detect the status of the power module DSP chip via ID1_OK (28), ID2_OK (29), ID3_OK (30), ID4_OK (31), ID5_OK (40) and ID6_OK (41). "Logic Low" means that the power module DSP chip is functioning properly. (ID5_OK and ID6_OK are not used for reserve.)

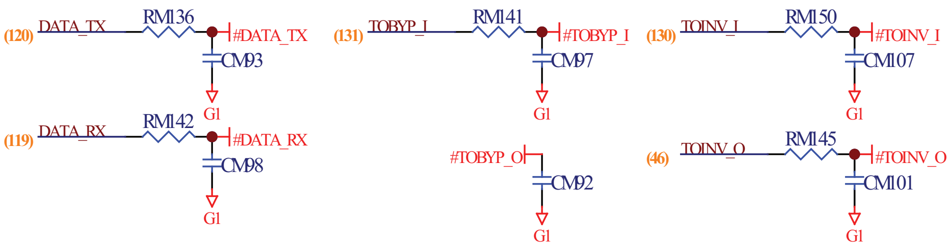
(d) ON is connected to the relay driver of the auxiliary power supply inside the power module. If POWER_ON (42) is "Logic H," then the auxiliary power supply inside the power module is on.

## 2.21 Control Circuit for Power Module *(continued)*

Located on NH-SYS-M board (System MCU and Control Circuit)


VS
+12VSF
CR35
G4
RR50
CR37
DATA_BUS
RR54
UR24
CR39
5VS
UR4D
#DATA_TX
ZR4
RR56
QR7
G4
5VS
G1
RR61
RR62
RR63
+12VSF
CR43
#DATA_RX
CR46
CR47
UR30
G1
RR1
RR2
QR1
5VS
VS
TOBYP
CR8
G1
5VS
CR4
UR3
ZR1
#TOBYP_O
UR4A
RR6
CR7
G1
G4
RR8
DR16
RR9
RR10
5VS
+12VSF
UR6
#TOBYP_I
CR10
CR9
RR12
G1
RR13
QR2
5VS
VS
TOINV
UR7
CR15
UR4B
ZR2
#TOINV_O
RR16
CR16
G4
RR18
DR17
RR19
RR20
5VS
+12VSF
UR10
#TOINV_I
CR19
CR18
G1

Located on NH-SYS-M board (System MCU and Control Circuit)

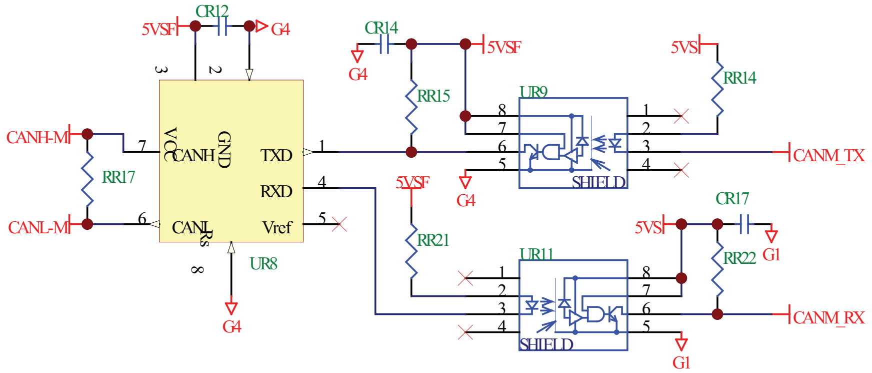

(120)
DATA_TX
RM136
#DATA_TX
CM93
G1
(131)
TOBYP_I
RM141
#TOBYP_I
CM97
G1
(130)
TOINV_I
RM150
#TOINV_I
CM107
G1
(119)
DATA_RX
RM142
#DATA_RX
CM98
G1
#TOBYP_O
CM92
G1
(46)
TOINV_O
RM145
#TOINV_O
CM101
G1

(e) DATA_BUS is the communication bus between the system and its power modules. This signal also connects to the external parallel port.

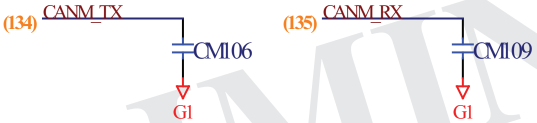
(f) TOBYP and TOINV are used to control the bypass or inverter transfer. The system frame and power module determine these signals together. These signals also connect to the external parallel port.

## 2.21 Control Circuit for Power Module *(continued)*

Located on NH-SYS-R board (Circuit for RS232, Output Dry Contact, Parallel Port, Connector to connect with each Power Module, Circuit for 2 Slots)


CR12
5VSF
G4
CR14
G4
5VSF
5VS
RR14
RR15
UR9
CANH-M
RR17
CANL-M
VCC
GND
CANH
TXD
RXD
CANL
Vref
Rs
UR8
G4
5VSF
G4
SHIELD
CANM_TX
CR17
5VS
G1
RR21
UR11
RR22
CANM_RX
SHIELD
G1

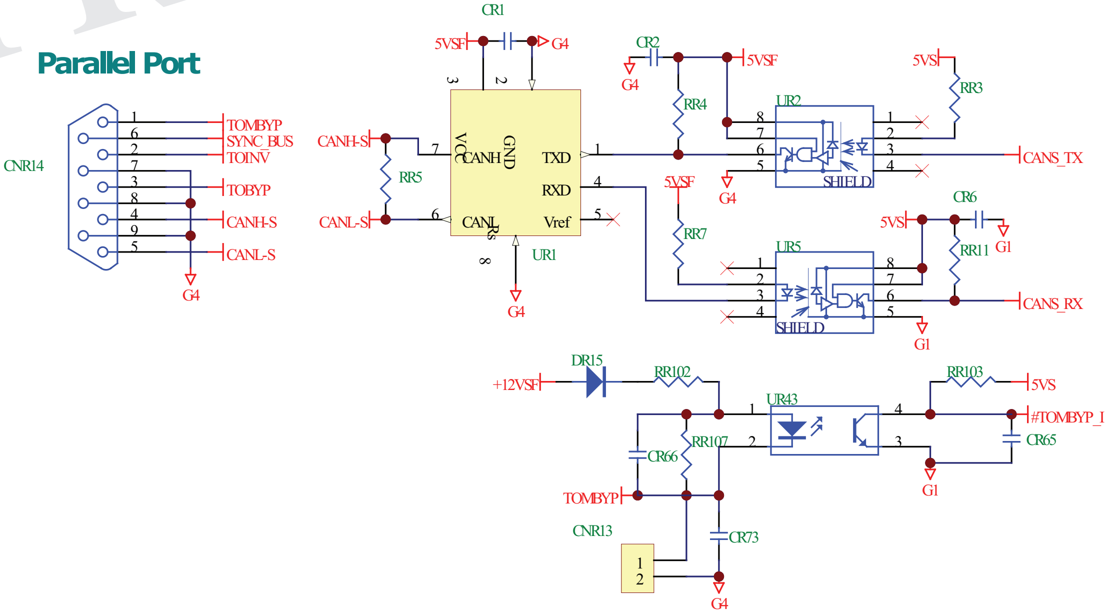
Located on NH-SYS-M board (System MCU and Control Circuit)


(134)
CANM_TX
CM106
G1
(135)
CANM_RX
CM109
G1

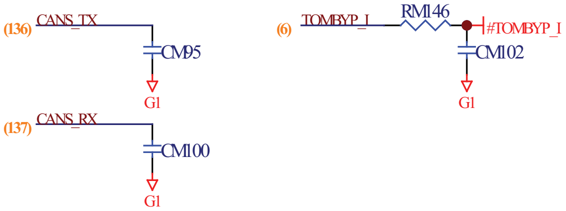
(g) CAN bus is the communication bus for load sharing, as well as the synchronization of signals between the system and its power modules.

**Control Circuit for External Parallel**

Located on NH-SYS-R board (Circuit for RS232, Output Dry Contact, Parallel Port, Connector to connect with each Power Module, Circuit for 2 Slots)


Parallel Port
CNR14
TOMBYP
SYNC_BUS
TOINV
TOBYP
CANH-S
CANL-S
G4
CR1
5VSF
G4
CANH-S
RR5
CANL-S
VCC
GND
CANH
TXD
RXD
CANL
Vref
Rs
UR1
G4
CR2
G4
5VSF
5VS
RR3
RR4
UR2
SHIELD
CANS_TX
5VSF
G4
CR6
5VS
G1
RR7
UR5
RR11
CANS_RX
SHIELD
G1
DR15
+12VSF
RR102
RR103
5VS
UR43
#TOMBYP_I
CR65
CR66
RR107
G1
TOMBYP
CNR13
CR73
G4

Located on NH-SYS-M board (System MCU and Control Circuit)


(136)
CANS_TX
CM95
G1
(137)
CANS_RX
CM100
G1
(6)
TOMBYP_I
RM146
#TOMBYP_I
CM102
G1

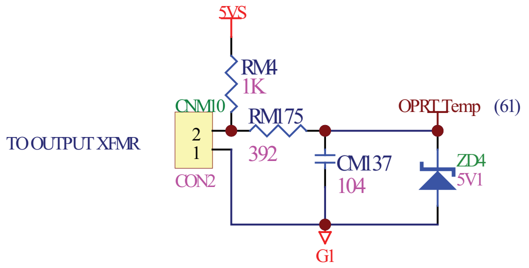
(h) CAN bus is the communication bus for load sharing, and also synchronizes signals between the two systems.

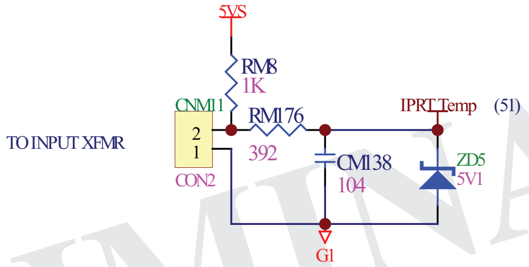
(i) TOMBYP is the status of the manual bypass switch on the system frame. When the manual bypass switch turns on, MCU can detect its status via TOMBYP_I(6) and auto-transfer to bypass the mode and its alarm.

## 2.22 Transformer Over Temperature Detection

(This function is only for SU40K, SU60K, SU80K, SU60KTV, and SU80KTV models)

Located on NH-M board (System MCU and Control Circuit)


5VS
RM4
1K
CNM10
RM175
392
OPRT_Temp (61)
TO OUTPUT XFMR
2
1
CON2
CM137
104
ZD4
5V1
G1


5VS
RM8
1K
CNM11
RM176
392
IPRT_Temp (51)
TO INPUT XFMR
2
1
CON2
CM138
104
ZD5
5V1
G1

(a) CNM10 connects to the output transformer, CNM11 connects to the input transformer.

(b) Thermal switch sensors are mounted on the coils of the transformer.

(c) The thermal switch sensor will be open when the transformer coil's temperature exceeds 150. MCU can detect the temperature status through IPRT_Temp (51) and OTRT_Temp (61).

***Note:*** *For international models (SU20KX, SU40KX, SU60KX and SU80KX), short-pins must be inserted into CNM10 and CNM11.*

# 3 Communication

**Warning: Do not use the paralleling cable that came with the UPS system for these procedures. Use a RS232 cable.**

### 3.01 RS232 Port

The UPS provides a RS232 port in one D-sub 9 female connector. This RS232 port performs the following functions:

3.1) Sets EEPROM on the NH-M board

3.2) Sets Output Dry Contact status

3.3) Upgrades the system board's firmware

3.4) Upgrades the power module's DSP firmware

3.5) Downloads the event log of the UPS

Use the straight through serial connection to communicate with the RS232 port. The pin assignment of the RS232 port D-sub 9 female connector is defined as follows:

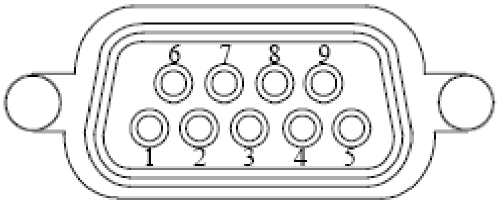


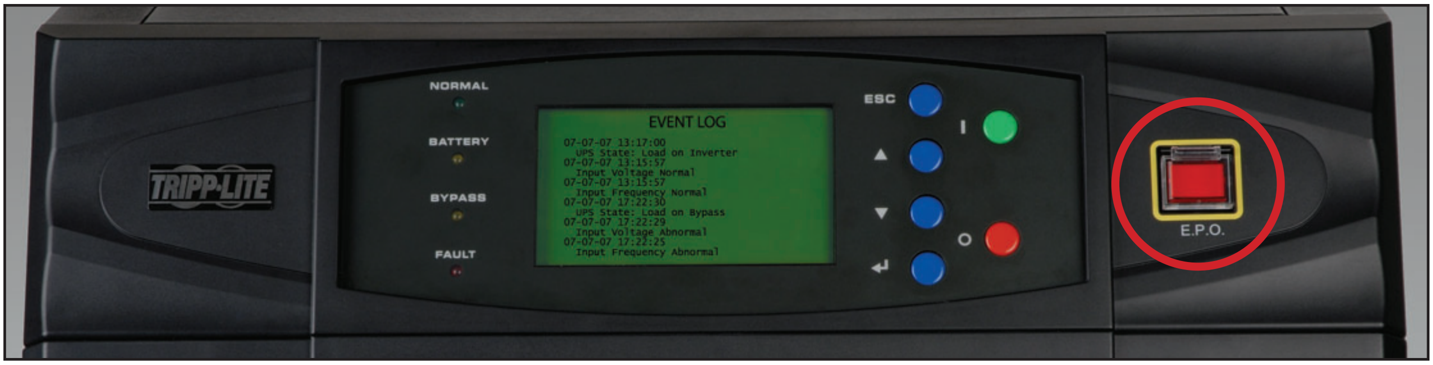
*Figure 3.01a RS232 Pin Assignment*

Pin 2: PC receives line RS-232 data from UPS.

Pin 3: PC transmits line RS-232 data to UPS.

Pin 5: Signal ground.

### 3.02 Emergency Power Off (EPO)



```
07-07-07 13:17:00
  UPS State: Load on Inverter
07-07-07 13:15:57
  Input Voltage Normal
07-07-07 13:15:57
  Input Frequency Normal
07-07-07 17:22:30
  UPS State: Load on Bypass
07-07-07 17:22:29
  Input Voltage Abnormal
07-07-07 17:22:25
  Input Frequency Abnormal
```

*Fig 3.02a Front Control Panel*

The EPO button on the front control panel (Figure 3.02a) turns the UPS system's output OFF and also disables its bypass output.

If the UPS system is in battery backup mode when the EPO button is activated:

- Main output and bypass output are turned off, the alarm sounds, fans shut down after approximately one minute, and control circuitry remains active.
- Pressing the EPO button again turns off the UPS system completely, including the alarm and control circuit. Press the ON button for three seconds to restart the UPS system.

If the UPS system is in online (normal) mode when the EPO button is activated:

- Main output and bypass output are turned off, the alarm sounds, fans and control circuitry remain active.
- Pressing the EPO button again turns off the alarm and places the UPS system in auto bypass mode. Press the ON button for three seconds to return the UPS system to online (normal) mode.

### Remote Emergency Power Off (REPO)

The Remote Emergency Power Off (REPO) input connection (P1 in Figure 3.02b) allows you to connect the UPS system to your facility's EPO circuit — enabling remote emergency shutdown of the UPS system's output. Connect EPO input to a user-supplied remote switch using the circuit diagram (Figure 3.02c).

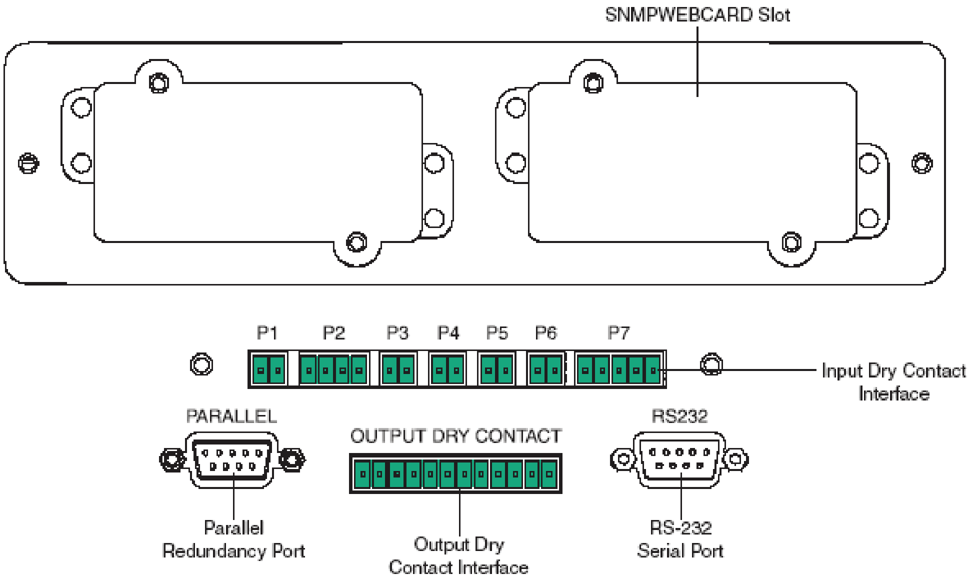
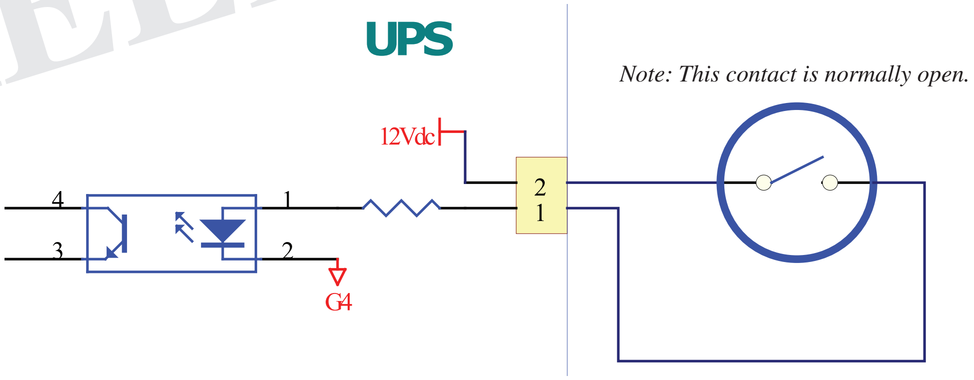

SNMPWEBCARD Slot
P1
P2
P3
P4
P5
P6
P7
Input Dry Contact Interface
PARALLEL
OUTPUT DRY CONTACT
RS232
Parallel Redundancy Port
Output Dry Contact Interface
RS-232 Serial Port

*Fig 3.02b*

PRELI


UPS
12Vdc
4
3
1
2
G4
2
1

*Note: This contact is normally open.*

*Fig 3.02c*

## 3.1 Setting EEPROM on the NH-M Board

### 3.1.1 Polling and Updating EEPROM

**WARNING: This procedure must be performed in bypass mode (see section 1.6).**

Instructions for polling and updating the EEPROM are as follows (Figure 3.1.1a):

a) Link the UPS with a PC via the RS232 port

b) Run the program "***NH_SYS_V1_3B1030.exe***"

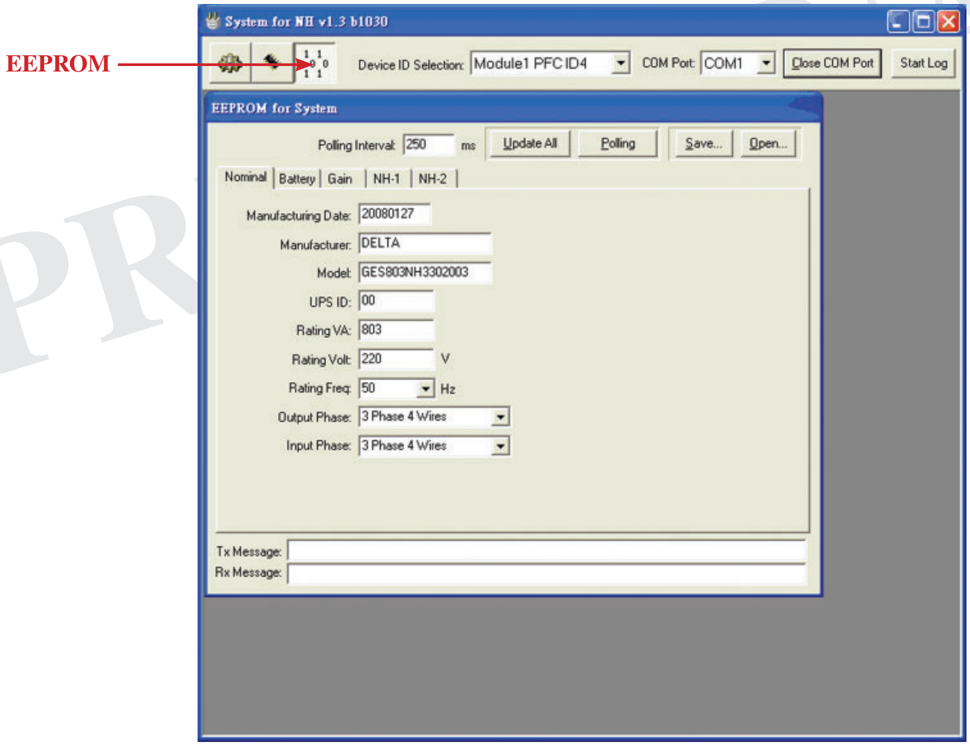
c) Click the "***EEPROM***" icon

d) Select the PC ***COM Port*** and click "***Open COM Port***"

e) Click "***Polling***" to download the EEPROM data from the UPS.

f) Save the file to ensure that you have the values in case they are needed later

g) After setting the data, click "***Update All***" and wait for the procedure to complete itself


EEPROM
System for NH v1.3 b1030
Close COM Port
Start Log
EEPROM for System
Update All
Polling
Save...
Open...
Nominal
Battery
Gain
NH-1
NH-2

Device ID Selection: Module1 PFC ID4

COM Port: COM1

Polling Interval: 250 ms

Manufacturing Date: 20080127

Manufacturer: DELTA

Model: GES803NH3302003

UPS ID: 00

Rating VA: 803

Rating Volt: 220 V

Rating Freq: 50 Hz

Output Phase: 3 Phase 4 Wires

Input Phase: 3 Phase 4 Wires

Tx Message:

Rx Message:

*Fig 3.1.1a*

## 3.1 Setting EEPROM on the NH-M Board *(continued)*

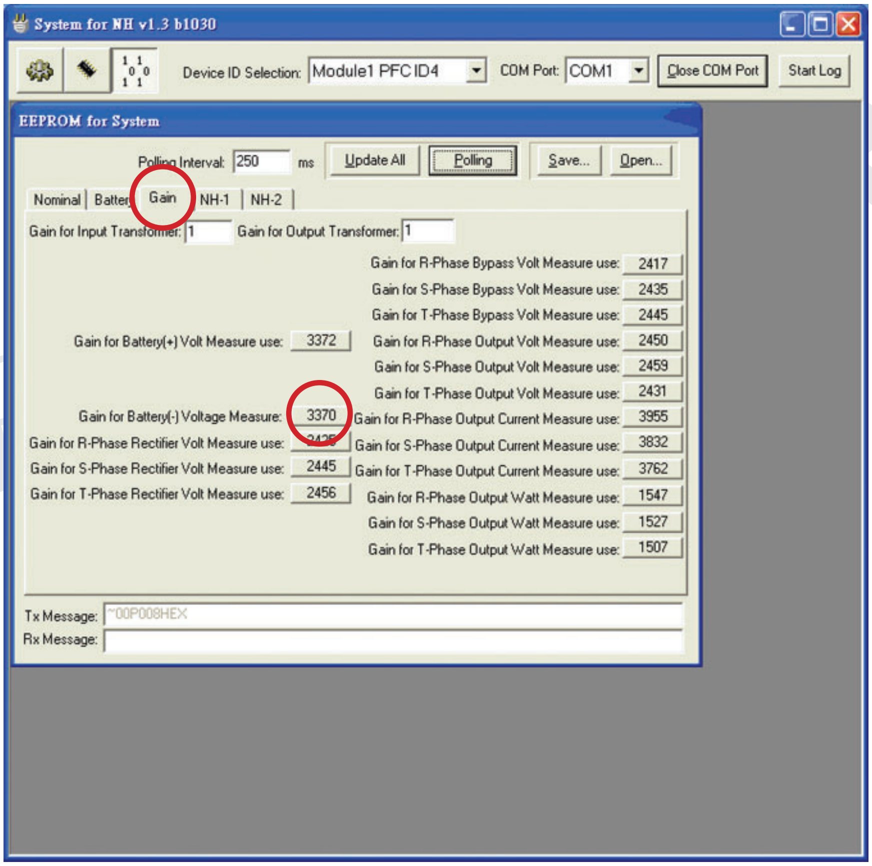
### 3.1.2 Calibrating EEPROM Gain

**WARNING: This procedure must be performed in bypass mode (see section 1.6).**

Instructions for calibrating the EEPROM gain of the UPS parameters are as follows:

(For polling procedure, please refer to section 3.1.1)

a) Click the "***Gain***" tab (Figure 3.1.2a)



Device ID Selection: Module1 PFC ID4
COM Port: COM1
Polling Interval: 250 ms
Gain for Input Transformer: 1
Gain for Output Transformer: 1
Gain for Battery(+) Volt Measure use: 3372
Gain for Battery(-) Voltage Measure: 3370
Gain for R-Phase Rectifier Volt Measure use: 2425
Gain for S-Phase Rectifier Volt Measure use: 2445
Gain for T-Phase Rectifier Volt Measure use: 2456
Gain for R-Phase Bypass Volt Measure use: 2417
Gain for S-Phase Bypass Volt Measure use: 2435
Gain for T-Phase Bypass Volt Measure use: 2445
Gain for R-Phase Output Volt Measure use: 2450
Gain for S-Phase Output Volt Measure use: 2459
Gain for T-Phase Output Volt Measure use: 2431
Gain for R-Phase Output Current Measure use: 3955
Gain for S-Phase Output Current Measure use: 3832
Gain for T-Phase Output Current Measure use: 3762
Gain for R-Phase Output Watt Measure use: 1547
Gain for S-Phase Output Watt Measure use: 1527
Gain for T-Phase Output Watt Measure use: 1507
Tx Message: ~00P008HEX
Rx Message:

*Fig 3.1.2a*

b) Select the parameter you want to calibrate and click its gain icon

c) Key in the actual value to the "***Actual Measured:***" column of the dialogue box

d) Key in the LCD value to the "***UPS Detected:***" column of the dialogue box

e) Click the "***Calculate***" icon (the New Gain Value will auto-calculate)

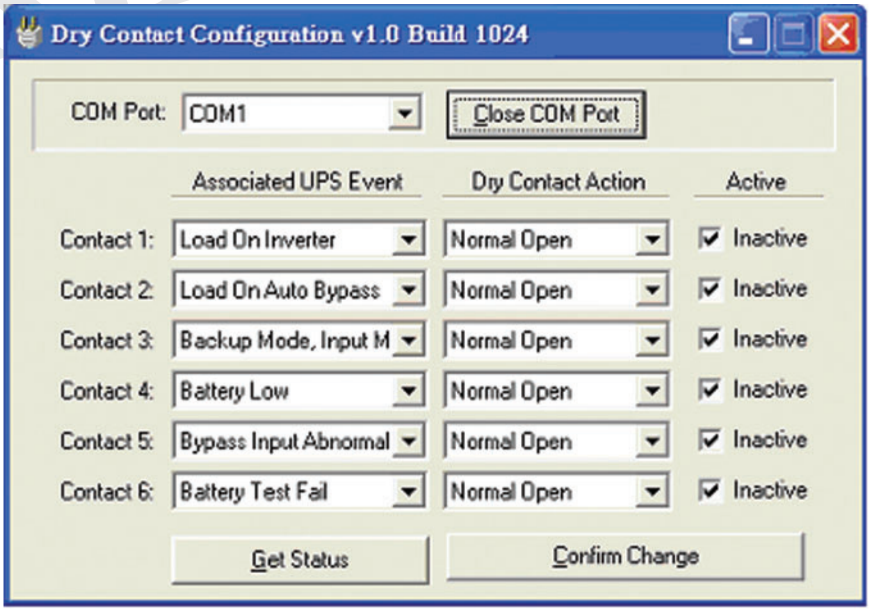
f) Click the "***OK***" icon (the dialogue box will close)

g) After calibrating the gain, click "***Update All***" and wait for the procedure to complete itself

## 3.2 Setting Output Dry Contact Status

The UPS provides six output dry contact closures. The status of each output dry contact closure can be programmed from 19 status events:

1. Load on inverter (**Default**)
2. Load on auto bypass (**Default**)
3. Backup mode input main failure (**Default**)
4. Battery low (**Default**)
5. Bypass input abnormal (**Default**)
6. Battery test failure (**Default**)
7. Internal communication failure
8. External parallel communication failure
9. Output overload warning/shutdown
10. Power module fault shutdown
11. Power module warning
12. EPO activated
13. Load on manual bypass
14. Battery cabinet over temperature warning/shutdown
15. Output voltage abnormal
16. Battery need replace
17. Bypass over temperature warning/shutdown
18. Battery ground fault
19. Bypass static switch fault



COM Port: COM1

| | Associated UPS Event | Dry Contact Action | Active |
|---|---|---|---|
| Contact 1: | Load On Inverter | Normal Open | ☑ Inactive |
| Contact 2: | Load On Auto Bypass | Normal Open | ☑ Inactive |
| Contact 3: | Backup Mode, Input M | Normal Open | ☑ Inactive |
| Contact 4: | Battery Low | Normal Open | ☑ Inactive |
| Contact 5: | Bypass Input Abnormal | Normal Open | ☑ Inactive |
| Contact 6: | Battery Test Fail | Normal Open | ☑ Inactive |

*Fig 3.2a*

To change the status of an output dry contact closure:

(a) Link the UPS with a PC via the RS232 port
(b) Run the program "***NH-Dry-Contact v1.0b1024.exe***" (Figure 3.2a)
(c) Select the PC ***COM Port*** and click "***Open COM Port***"
(d) Click "***Get Status***" to poll the UPS settings
(e) After you change the status, click "***Confirm Change***" to update the UPS settings

## 3.3 Upgrading Firmware for the System Board

**WARNING: Make sure that the UPS is in bypass mode and that all power modules have been completely de-energized.**

**WARNING: When the system is in manual bypass mode, bypass power is still present in the output terminal block.**

Before upgrading your firmware, please verify the firmware version using the control panel (Figure 3.3a).
(Maintenance ⟶ Others ⟶ SN & FW Version)

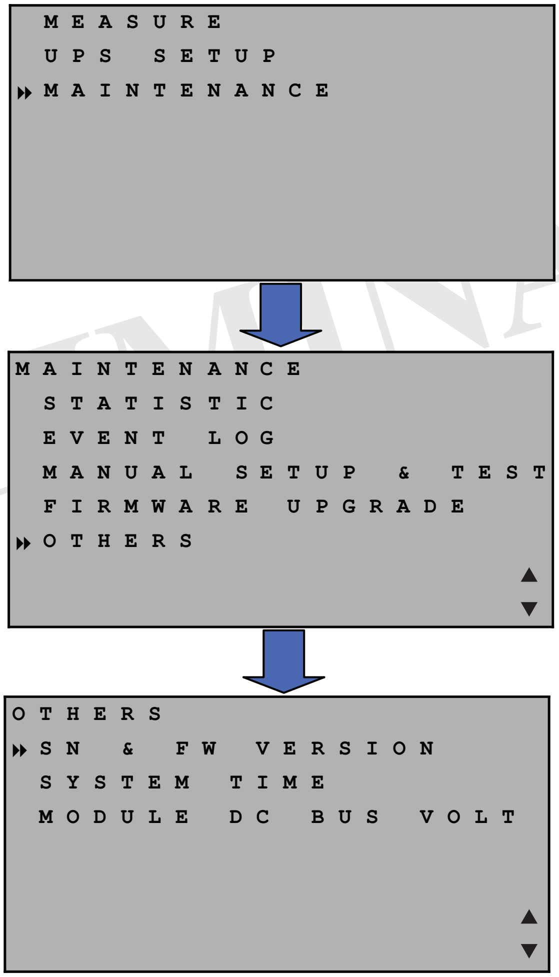
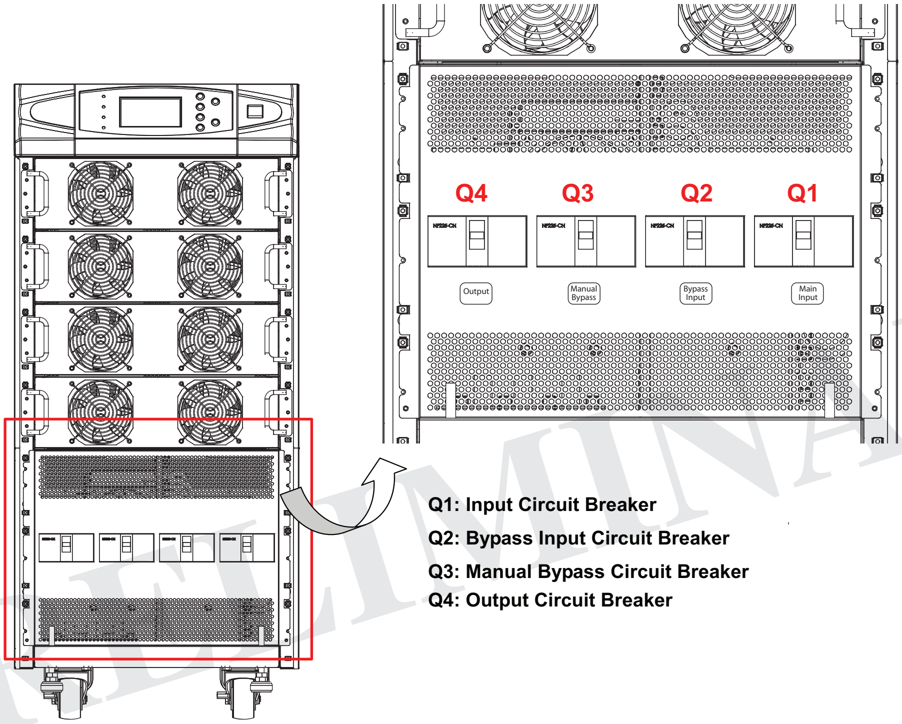

MEASURE
UPS SETUP
⏩ MAINTENANCE
MAINTENANCE
STATISTIC
EVENT LOG
MANUAL SETUP & TEST
FIRMWARE UPGRADE
⏩ OTHERS
▲
▼
OTHERS
⏩ SN & FW VERSION
SYSTEM TIME
MODULE DC BUS VOLT
▲
▼

*Fig 3.3a*

## 3.3 Upgrading Firmware for the System Board *(continued)*

To upgrade the system's firmware:

a) Confirm that the Main Input Breaker (Q1) and Output Breaker (Q4) are both ***OFF***, and that Bypass Input Breaker (Q2) and Manual Bypass Breaker (Q3) are both ***ON*** (Figure 3.3b).


Q4
Q3
Q2
Q1
Output
Manual Bypass
Bypass Input
Main Input

**Q1: Input Circuit Breaker**
**Q2: Bypass Input Circuit Breaker**
**Q3: Manual Bypass Circuit Breaker**
**Q4: Output Circuit Breaker**

*Fig 3.3b*

## 3.3 Upgrading Firmware for the System Board *(continued)*

b) Select “System Firmware Upgrade” using the LCD panel (Figure 3.3c).

(Maintenance ⟶ Firmware Upgrade ⟶ Login (Administrator) ⟶ System Firmware)

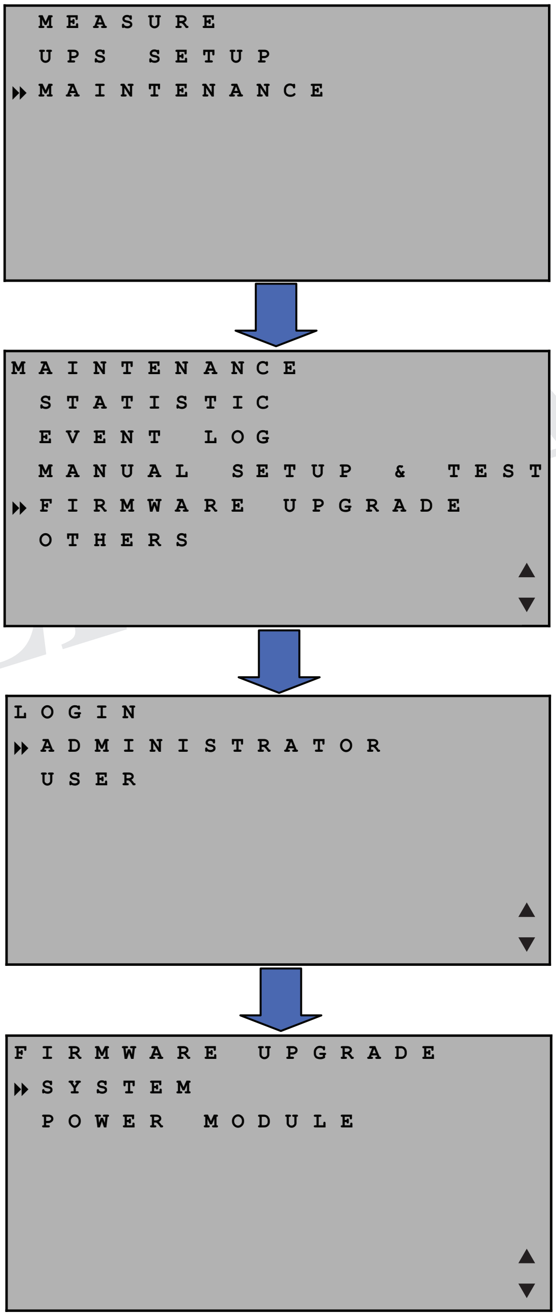
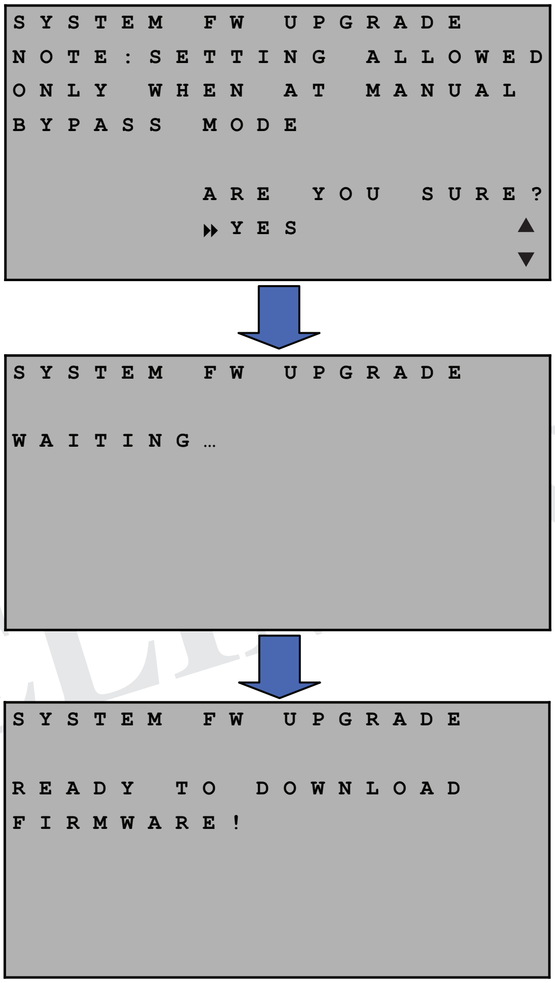

MEASURE
UPS SETUP
MAINTENANCE
MAINTENANCE
STATISTIC
EVENT LOG
MANUAL SETUP & TEST
FIRMWARE UPGRADE
OTHERS
LOGIN
ADMINISTRATOR
USER
FIRMWARE UPGRADE
SYSTEM
POWER MODULE

*Fig 3.3c*

## 3.3 Upgrading Firmware for the System Board *(continued)*

c) After confirming the command, wait for the LCD to display “READY TO DOWNLOAD FIRMWARE!” (Figure 3.3d).



```
SYSTEM FW UPGRADE
NOTE:SETTING ALLOWED
ONLY WHEN AT MANUAL
BYPASS MODE

       ARE YOU SURE?
       ⏩YES             ▲
                        ▼
```

```
SYSTEM FW UPGRADE

WAITING…
```

```
SYSTEM FW UPGRADE

READY TO DOWNLOAD
FIRMWARE!
```

Fig 3.3d

***Note 1:*** *Once you confirm the command, the system will go into “system firmware upgrade” mode. If you want to cancel the upgrade command before programming, the BYPASS input breaker (Q2) must be turned off.*

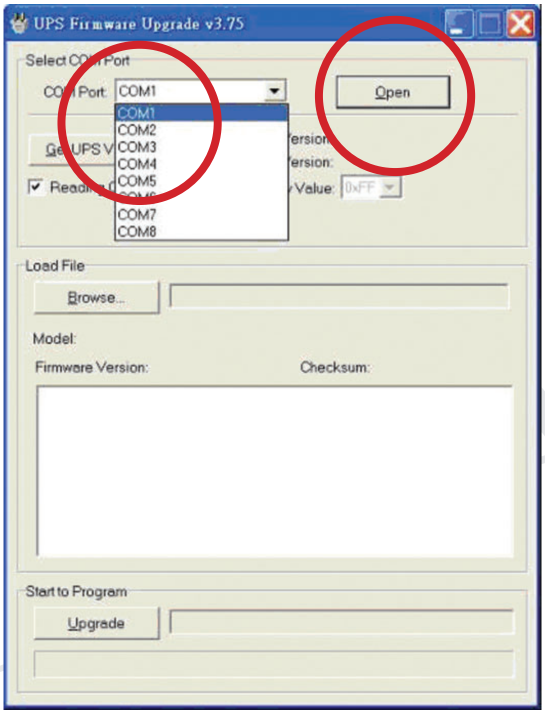
***Note 2:*** *The Firmware Upgrade setting is only allowed in manual bypass mode.*

d) Link the UPS with a PC via the RS232 port.

## 3.3 Upgrading Firmware for the System Board *(continued)*

e) Run the program "***FSL 3.75.exe***" (Figure 3.3e).

f) Select the PC ***COM Port*** and Click "***Open.***"

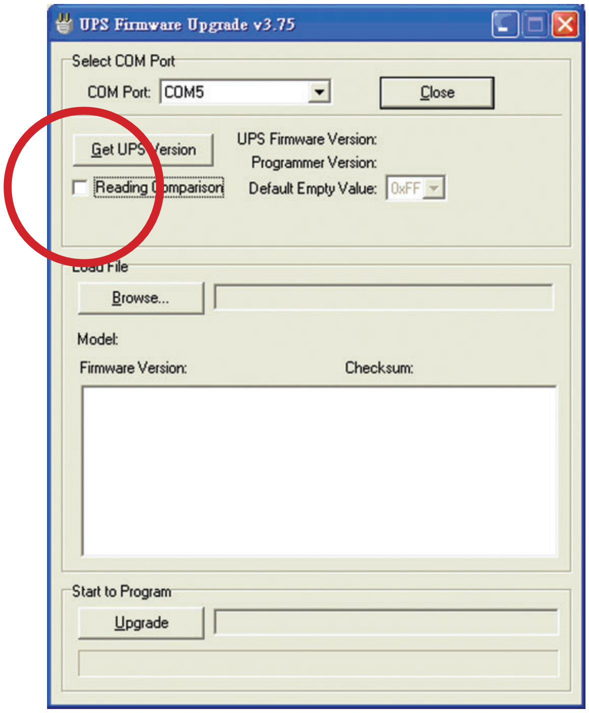

UPS Firmware Upgrade v3.75
Select COM Port
COM1
COM2
COM3
COM4
COM5
COM7
COM8
Open
Get UPS V
Reading C
ersion:
ersion:
Value:
0xFF
Load File
Browse...
Model:
Firmware Version:
Checksum:
Start to Program
Upgrade

COM Port: COM1

*Fig 3.3e*

PREL ARY

g) Disable "***Reading Comparison***" (Figure 3.3f).


UPS Firmware Upgrade v3.75
Select COM Port
Close
Get UPS Version
UPS Firmware Version:
Programmer Version:
Load File
Browse...
Model:
Firmware Version:
Checksum:
Start to Program
Upgrade

COM Port: COM5

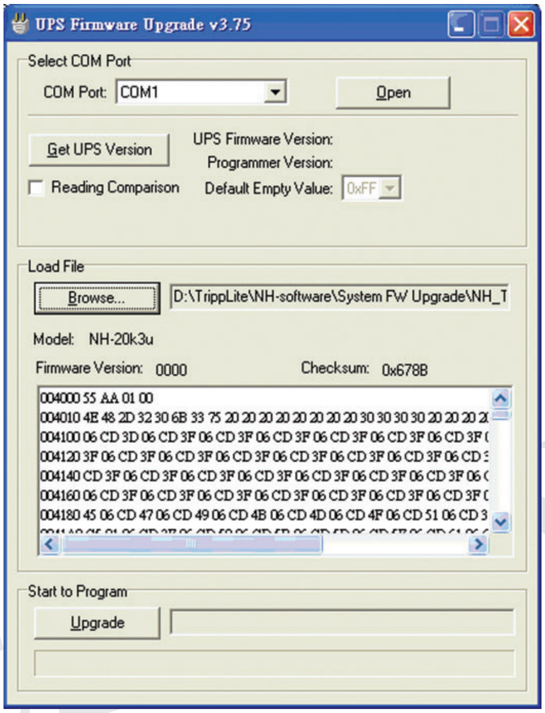
☐ Reading Comparison

Default Empty Value: 0xFF

*Fig 3.3f*

## 3.3 Upgrading Firmware for the System Board *(continued)*

h) Load the new firmware file and click “***Upgrade***” (Figure 3.3g).


UPS Firmware Upgrade v3.75
Select COM Port
Open
Get UPS Version
UPS Firmware Version:
Programmer Version:
Load File
Browse...
Start to Program
Upgrade

COM Port: COM1

☐ Reading Comparison

Default Empty Value: 0xFF

D:\TrippLite\NH-software\System FW Upgrade\NH_T

Model: NH-20k3u

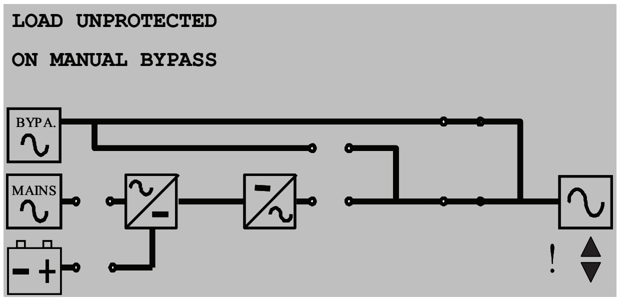
Firmware Version: 0000

Checksum: 0x678B

```
004000 55 AA 01 00
004010 4E 48 2D 32 30 6B 33 75 20 20 20 20 20 20 20 20 30 30 30 30 20 20 20 2
004100 06 CD 3D 06 CD 3F 06 CD 3F 06 CD 3F 06 CD 3F 06 CD 3F 06 CD 3F
004120 3F 06 CD 3F 06 CD 3F 06 CD 3F 06 CD 3F 06 CD 3F 06 CD 3F 06 CD
004140 CD 3F 06 CD 3F 06 CD 3F 06 CD 3F 06 CD 3F 06 CD 3F 06 CD 3F 06
004160 06 CD 3F 06 CD 3F 06 CD 3F 06 CD 3F 06 CD 3F 06 CD 3F 06 CD 3F
004180 45 06 CD 47 06 CD 49 06 CD 4B 06 CD 4D 06 CD 4F 06 CD 51 06 CD 3
```

*Fig 3.3g*

i) Once the system finished upgrading its firmware, it will auto-reset into manual bypass mode (Figure 3.4h).



LOAD UNPROTECTED

ON MANUAL BYPASS

*Fig 3.3h*

## 3.4 Upgrading Firmware for the Power Module

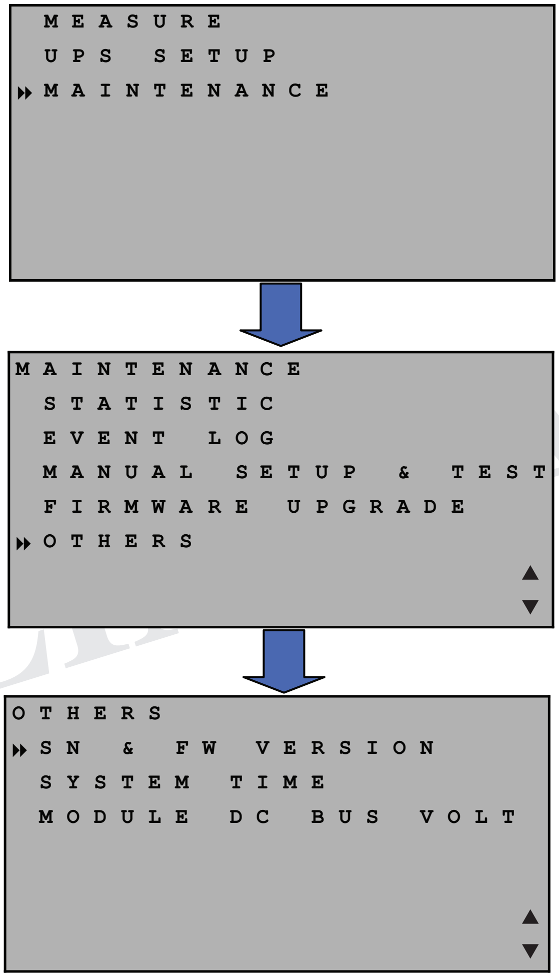
**WARNING: Make sure that the UPS is in bypass mode and that all power modules have been completely de-energized.**

**WARNING: When the system is in manual bypass mode, bypass power is still present in the output terminal block.**

## 3.4 Upgrading Firmware for the Power Module *(continued)*

Before upgrading your firmware, please verify the firmware version using the control panel (Fig 3.4a).

(Maintenance ⟶ Others ⟶ SN & FW Version)



MEASURE
UPS SETUP
▸▸ MAINTENANCE

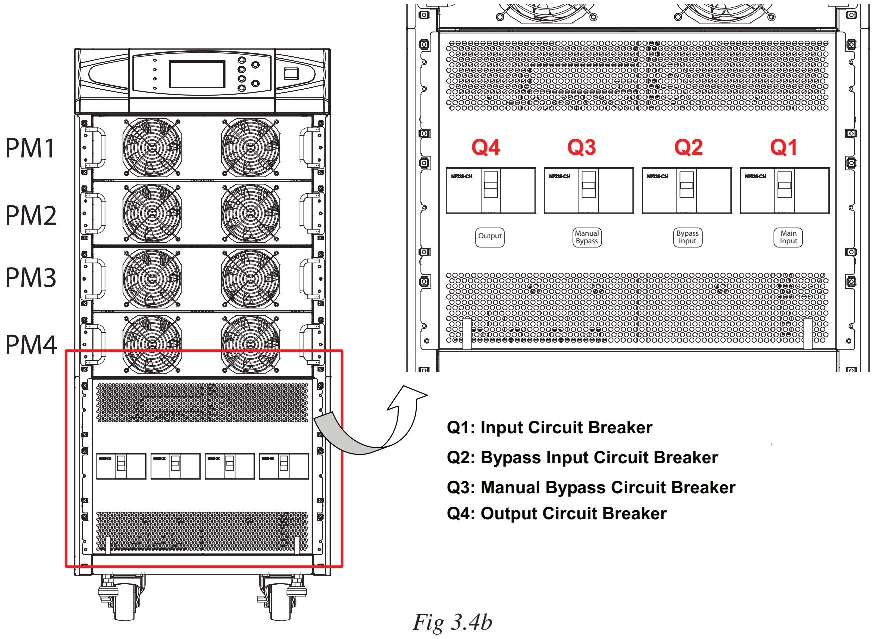
MAINTENANCE
STATISTIC
EVENT LOG
MANUAL SETUP & TEST
FIRMWARE UPGRADE
▸▸ OTHERS

OTHERS
▸▸ SN & FW VERSION
SYSTEM TIME
MODULE DC BUS VOLT

*Fig 3.4a*

To upgrade the power module's firmware:

a) Confirm that the Main Input Breaker (Q1) and Output Breaker (Q4) are both OFF, and that the Bypass Input Breaker (Q2) and Manual Bypass Breaker (Q3) are both ON. (Figure 3.4b)



**Q1: Input Circuit Breaker**
**Q2: Bypass Input Circuit Breaker**
**Q3: Manual Bypass Circuit Breaker**
**Q4: Output Circuit Breaker**

*Fig 3.4b*

## 3.4 Upgrading Firmware for the Power Module *(continued)*

***Note:*** *Confirm that you've turned on the breaker for the external battery cabinet or internal battery.*

b) Select "***Power Module Firmware Upgrade***" using the LCD panel. (Figure 3.4c) (Maintenance ⟶ Firmware Upgrade ⟶ Login (Administrator) ⟶ Power Module Firmware)

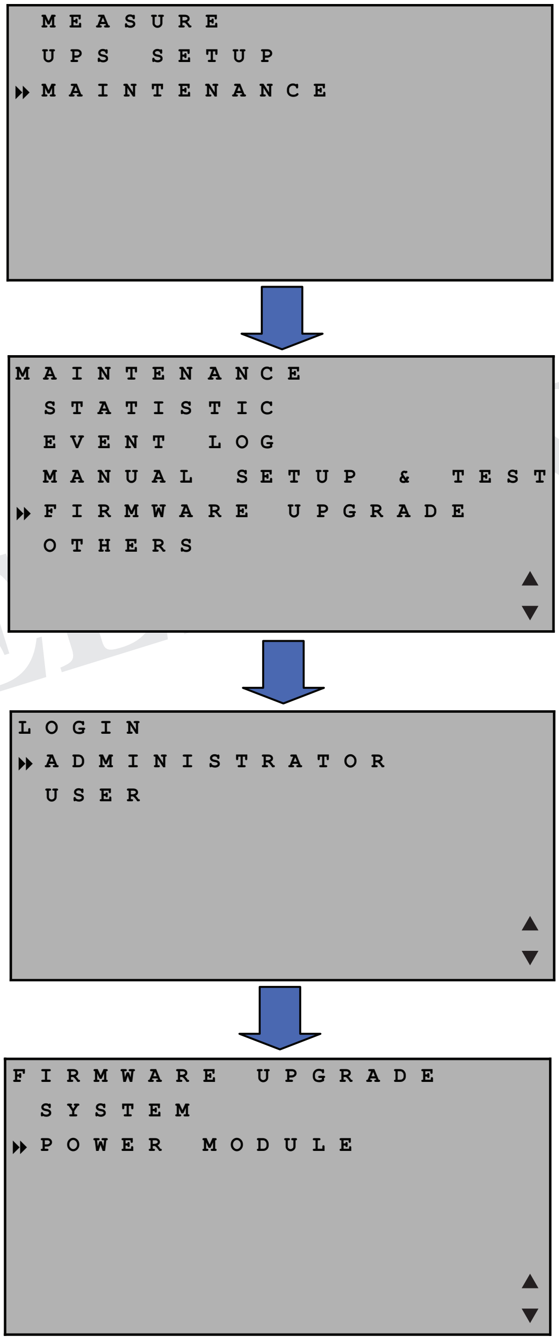
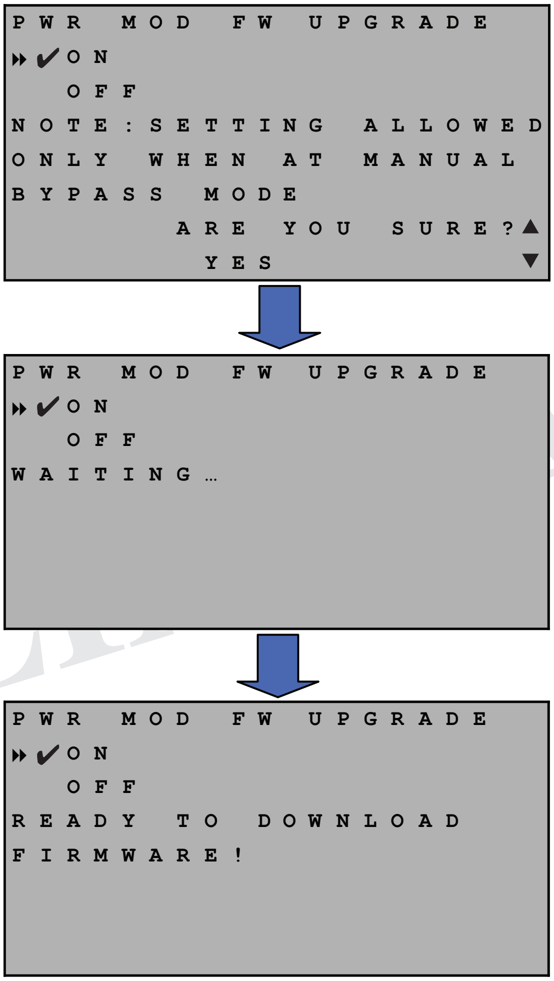

MEASURE
UPS SETUP
▸▸ MAINTENANCE
MAINTENANCE
STATISTIC
EVENT LOG
MANUAL SETUP & TEST
▸▸ FIRMWARE UPGRADE
OTHERS
▲
▼
LOGIN
▸▸ ADMINISTRATOR
USER
▲
▼
FIRMWARE UPGRADE
SYSTEM
▸▸ POWER MODULE
▲
▼

*Fig 3.4c*

## 3.4 Upgrading Firmware for the Power Module *(continued)*

c) Select “ON” to upgrade the power module’s firmware and press “↵” to confirm the command. Wait for the LCD to display “READY TO DOWNLOAD FIRMWARE!” (Figure 3.4d).



```
PWR MOD FW UPGRADE
»✔ON
  OFF
NOTE:SETTING ALLOWED
ONLY WHEN AT MANUAL
BYPASS MODE
      ARE YOU SURE?▲
       YES         ▼
```

```
PWR MOD FW UPGRADE
»✔ON
  OFF
WAITING…
```

```
PWR MOD FW UPGRADE
»✔ON
  OFF
READY TO DOWNLOAD
FIRMWARE!
```

*Fig 3.4d*

***Note 1:*** *Once you confirm the command, the system will go into “system firmware upgrade” mode. If you want to cancel the upgrade command before programming, the BYPASS input breaker (Q2) must be turned off.*

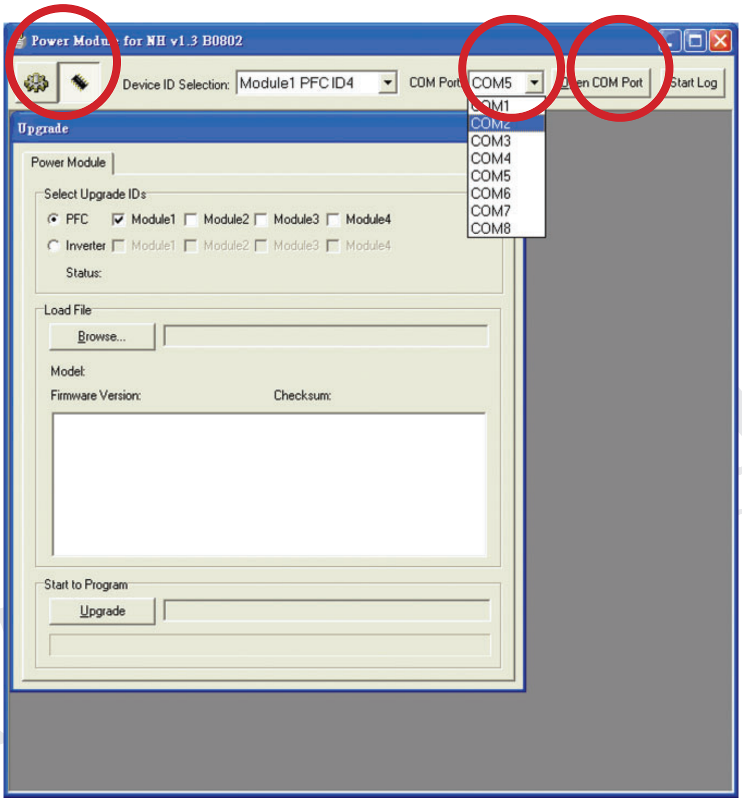
***Note 2:*** *The Firmware Upgrade setting is only allowed in manual bypass mode.*

d) Link the UPS to a PC via the RS232 port.

## 3.4 Upgrading Firmware for the Power Module *(continued)*

e) Run the program "***NH_PM_V1_4B1207.exe***" (Figure 3.4e).

f) Click the "***Firmware Upgrade***" icon, select PC ***COM Port*** and click "***Open COM Port.***"



Power Module for NH v1.3 B0802

Device ID Selection: Module1 PFC ID4

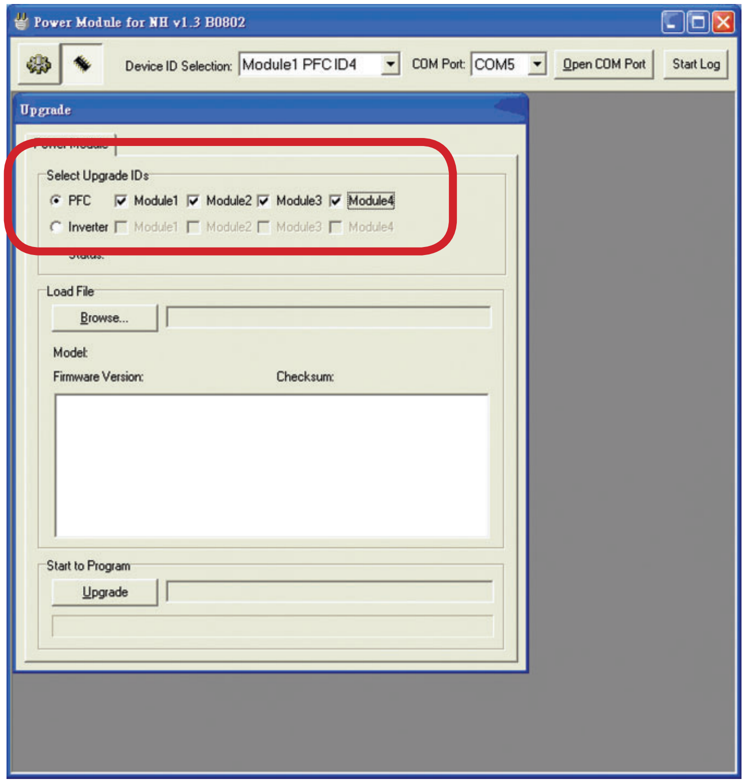
COM Port: COM5

COM1
COM2
COM3
COM4
COM5
COM6
COM7
COM8
Open COM Port
Start Log
Upgrade
Power Module
Select Upgrade IDs
PFC
Module1
Module2
Module3
Module4
Inverter
Status:
Load File
Browse...
Model:
Firmware Version:
Checksum:
Start to Program
Upgrade

PR
ARY

*Fig 3.4e*

g) Select the PFC DSP chip or INV DSP chip, along with power modules 1-4 (Figure 3.4f).



Power Module for NH v1.3 B0802

Device ID Selection: Module1 PFC ID4

COM Port: COM5

Select Upgrade IDs

● PFC ☑ Module1 ☑ Module2 ☑ Module3 ☑ Module4

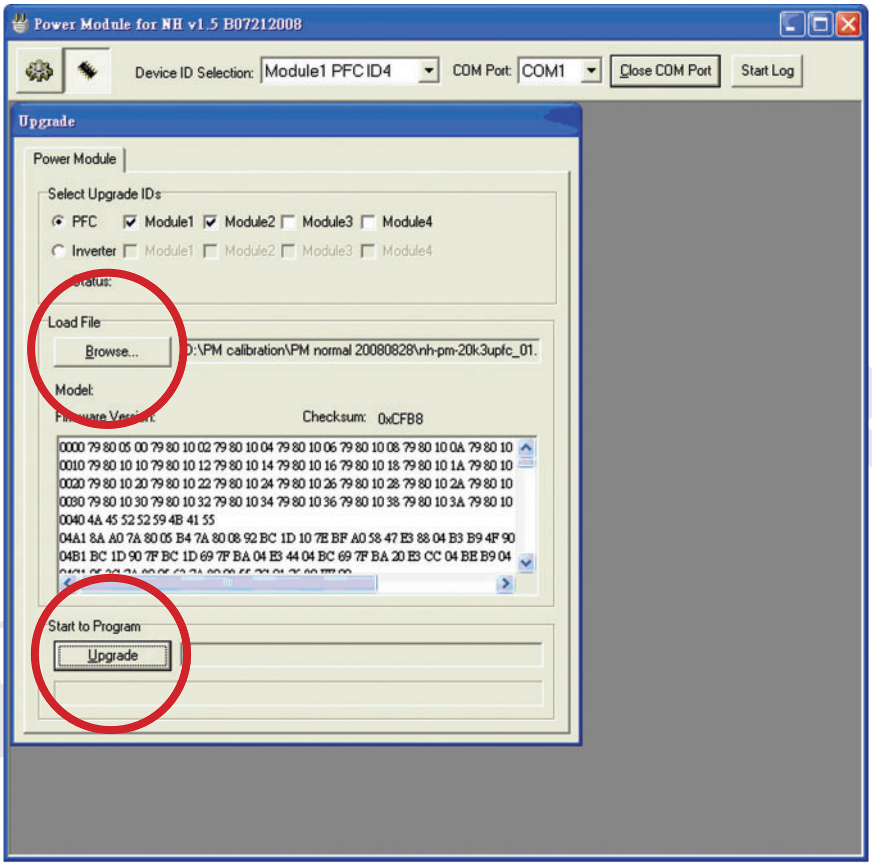
○ Inverter ☐ Module1 ☐ Module2 ☐ Module3 ☐ Module4

Open COM Port
Start Log
Upgrade
Power Module
Status:
Load File
Browse...
Model:
Firmware Version:
Checksum:
Start to Program
Upgrade

*Fig 3.4f*

## 3.4 Upgrading Firmware for the Power Module *(continued)*

h) Load the new firmware file for the PFC (or Inverter) and click “***Upgrade***” (Figure 3.4g).



Power Module for NH v1.5 B07212008
Close COM Port
Start Log
Upgrade
Power Module
Select Upgrade IDs
Load File
Browse...
Start to Program
Upgrade

Device ID Selection: Module1 PFC ID4

COM Port: COM1

● PFC ☑ Module1 ☑ Module2 ☐ Module3 ☐ Module4

○ Inverter ☐ Module1 ☐ Module2 ☐ Module3 ☐ Module4

Status:

D:\PM calibration\PM normal 20080828\nh-pm-20k3upfc_01.

Model:

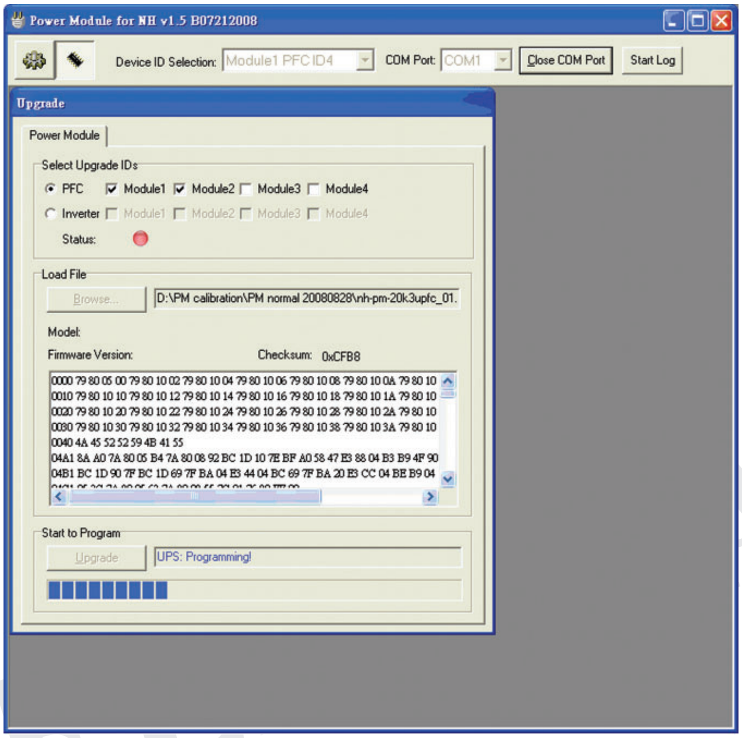
Firmware Version:

Checksum: 0xCFB8

```
0000 79 80 05 00 79 80 10 02 79 80 10 04 79 80 10 06 79 80 10 08 79 80 10 0A 79 80 10
0010 79 80 10 10 79 80 10 12 79 80 10 14 79 80 10 16 79 80 10 18 79 80 10 1A 79 80 10
0020 79 80 10 20 79 80 10 22 79 80 10 24 79 80 10 26 79 80 10 28 79 80 10 2A 79 80 10
0030 79 80 10 30 79 80 10 32 79 80 10 34 79 80 10 36 79 80 10 38 79 80 10 3A 79 80 10
0040 4A 45 52 52 59 4B 41 55
04A1 8A A0 7A 80 05 B4 7A 80 08 92 BC 1D 10 7E BF A0 58 47 E3 88 04 B3 B9 4F 90
04B1 BC 1D 90 7F BC 1D 69 7F BA 04 E3 44 04 BC 69 7F BA 20 E3 CC 04 BE B9 04
```

*Fig 3.4g*

## 3.4 Upgrading Firmware for the Power Module *(continued)*



Device ID Selection: Module1 PFC ID4
COM Port: COM1

Select Upgrade IDs
● PFC ☑ Module1 ☑ Module2 ☐ Module3 ☐ Module4
○ Inverter ☐ Module1 ☐ Module2 ☐ Module3 ☐ Module4
Status: 🔴

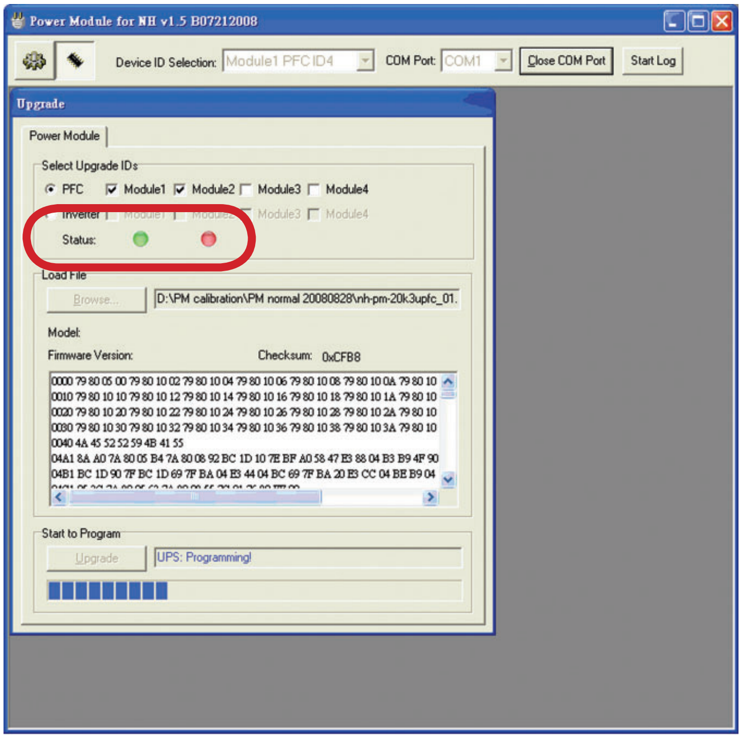
Load File
D:\PM calibration\PM normal 20080828\nh-pm-20k3upfc_01.
Model:
Firmware Version:
Checksum: 0xCFB8

```
0000 79 80 05 00 79 80 10 02 79 80 10 04 79 80 10 06 79 80 10 08 79 80 10 0A 79 80 10
0010 79 80 10 10 79 80 10 12 79 80 10 14 79 80 10 16 79 80 10 18 79 80 10 1A 79 80 10
0020 79 80 10 20 79 80 10 22 79 80 10 24 79 80 10 26 79 80 10 28 79 80 10 2A 79 80 10
0030 79 80 10 30 79 80 10 32 79 80 10 34 79 80 10 36 79 80 10 38 79 80 10 3A 79 80 10
0040 4A 45 52 52 59 4B 41 55
04A1 8A A0 7A 80 05 B4 7A 80 08 92 BC 1D 10 7E BF A0 58 47 E3 88 04 B3 B9 4F 90
04B1 BC 1D 90 7F BC 1D 69 7F BA 04 E3 44 04 BC 69 7F BA 20 E3 CC 04 BE B9 04
```

Start to Program
UPS: Programming!

Fig 3.4h

**Note 1:** *During programming, the status indicator is red. When upgrade is complete, the status indicator will turn green (Figure 3.4h).*



Device ID Selection: Module1 PFC ID4
COM Port: COM1

Select Upgrade IDs
● PFC ☑ Module1 ☑ Module2 ☐ Module3 ☐ Module4
○ Inverter ☐ Module1 ☐ Module2 ☐ Module3 ☐ Module4
Status: 🟢 🔴

Load File
D:\PM calibration\PM normal 20080828\nh-pm-20k3upfc_01.
Model:
Firmware Version:
Checksum: 0xCFB8

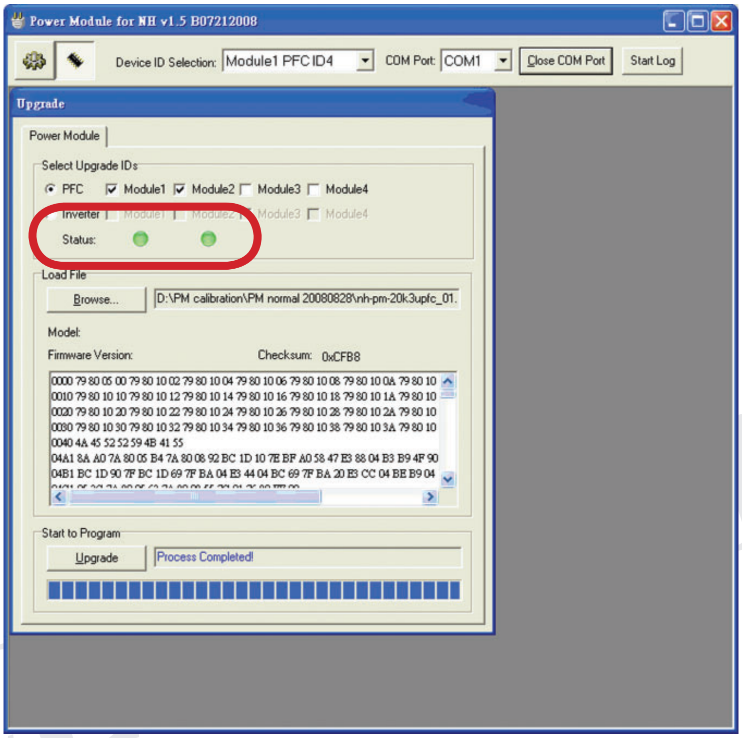
```
0000 79 80 05 00 79 80 10 02 79 80 10 04 79 80 10 06 79 80 10 08 79 80 10 0A 79 80 10
0010 79 80 10 10 79 80 10 12 79 80 10 14 79 80 10 16 79 80 10 18 79 80 10 1A 79 80 10
0020 79 80 10 20 79 80 10 22 79 80 10 24 79 80 10 26 79 80 10 28 79 80 10 2A 79 80 10
0030 79 80 10 30 79 80 10 32 79 80 10 34 79 80 10 36 79 80 10 38 79 80 10 3A 79 80 10
0040 4A 45 52 52 59 4B 41 55
04A1 8A A0 7A 80 05 B4 7A 80 08 92 BC 1D 10 7E BF A0 58 47 E3 88 04 B3 B9 4F 90
04B1 BC 1D 90 7F BC 1D 69 7F BA 04 E3 44 04 BC 69 7F BA 20 E3 CC 04 BE B9 04
```

Start to Program
UPS: Programming!

Fig 3.4i

**Note 2:** *When one power module upgrade is complete, the system will automatically begin upgrading the next power module (Figure 3.4i).*

## 3.4 Upgrading Firmware for the Power Module *(continued)*



Device ID Selection: Module1 PFC ID4
COM Port: COM1

Select Upgrade IDs
● PFC ☑ Module1 ☑ Module2 ☐ Module3 ☐ Module4
○ Inverter ☐ Module1 ☐ Module2 ☐ Module3 ☐ Module4
Status: ● ●

Load File
D:\PM calibration\PM normal 20080828\nh-pm-20k3upfc_01.

Model:
Firmware Version:
Checksum: 0xCFB8

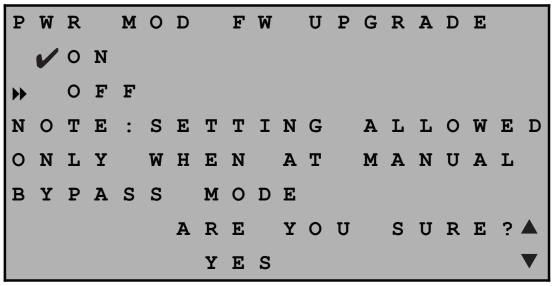
```
0000 79 80 05 00 79 80 10 02 79 80 10 04 79 80 10 06 79 80 10 08 79 80 10 0A 79 80 10
0010 79 80 10 10 79 80 10 12 79 80 10 14 79 80 10 16 79 80 10 18 79 80 10 1A 79 80 10
0020 79 80 10 20 79 80 10 22 79 80 10 24 79 80 10 26 79 80 10 28 79 80 10 2A 79 80 10
0030 79 80 10 30 79 80 10 32 79 80 10 34 79 80 10 36 79 80 10 38 79 80 10 3A 79 80 10
0040 4A 45 52 52 59 4B 41 55
04A1 8A A0 7A 80 05 B4 7A 80 08 92 BC 1D 10 7E BF A0 58 47 E3 88 04 B3 B9 4F 90
04B1 BC 1D 90 7F BC 1D 69 7F BA 04 E3 44 04 BC 69 7F BA 20 E3 CC 04 BE B9 04
```

Start to Program
Process Completed!

Fig 3.4j

***Note 3:*** *Once all power modules are complete, the status indicators will all turn green (Figure 3.4j).*

i) Once all firmware upgrades are complete, select "***OFF***" to disable the power module firmware upgrade. (Figure 3.4k)



```
PWR MOD FW UPGRADE
 ✓ON
▸▸ OFF
NOTE:SETTING ALLOWED
ONLY WHEN AT MANUAL
BYPASS MODE
        ARE YOU SURE?▲
          YES        ▼
```

Fig 3.4k

***Note:*** *When you disable the power module's firmware upgrade, the power module will reset and shut down.*

## 3.5 Downloading the Event Log

To download the UPS event log:

a) Link the UPS with a PC via the RS232 port.

b) Run the program "***NH-EventLog v1.0b1115.exe***" (Figure 3.5a).

c) Select PC ***COM Port*** and click "***Open COM Port.***"

d) Click "***Get UPS Event Log***" (Figure 3.5b).

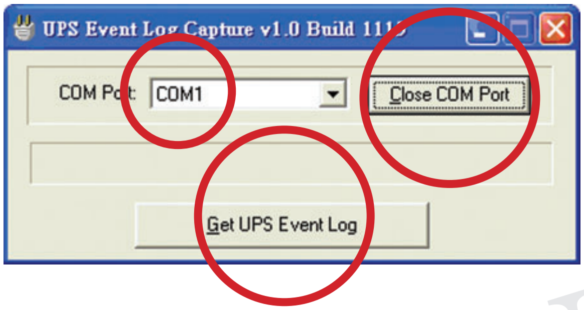
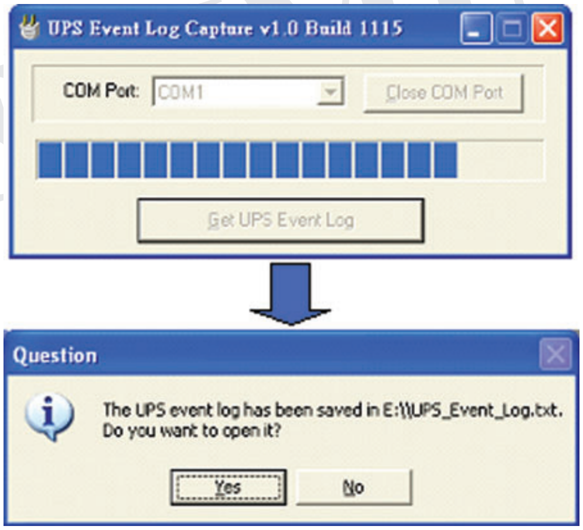

UPS Event Log Capture v1.0 Build 1115
COM Port:
COM1
Close COM Port
Get UPS Event Log

*Fig 3.5a*


UPS Event Log Capture v1.0 Build 1115
COM Port:
COM1
Close COM Port
Get UPS Event Log
Question
Yes
No

The UPS event log has been saved in E:\\UPS_Event_Log.txt.
Do you want to open it?

*Fig 3.5b*

# 4 Internal Battery

The SU20KX, SU40KX and SU40K models all use a +/-240Vdc (480V) DC internal battery system. An internal battery pack (number of packs vary by model) supplies the UPS system with battery backup power. Each internal battery pack consists of 40 12Vdc VRLA batteries arranged in two strings: one string of 20 positive batteries (black cable) and one string of 20 negative batteries (red cable). The two strings are connected by a neutral (N) point (See Figure 4a).

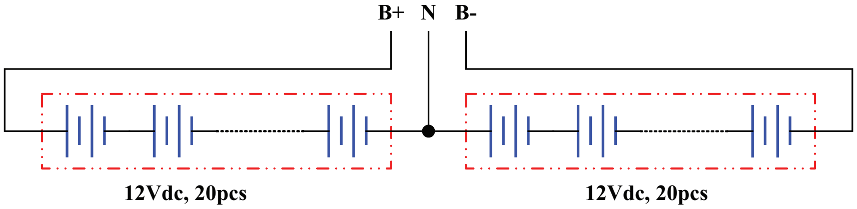


*Fig 4a Battery Strings*

All other KX, K and KTV models are designed with an external battery cabinet.

Both the SU20KX and SU40KX model's internal battery space (Figure 4b) can hold eight battery packs. Each battery pack contains 10 batteries (9AH, 12Vdc, VRLA), giving them a maximum capacity of 80 batteries.

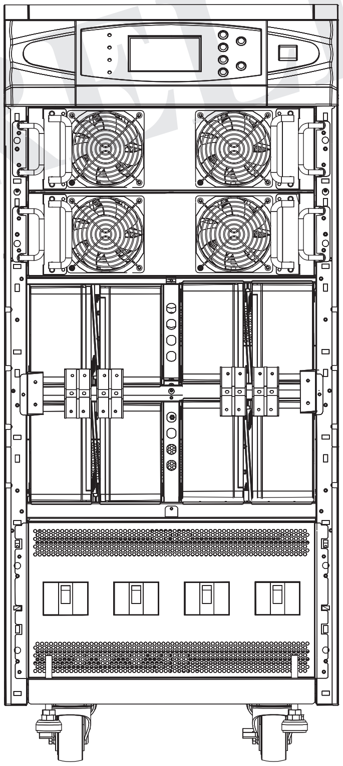


*Fig 4b Front View of SU20KX and SU40KX*

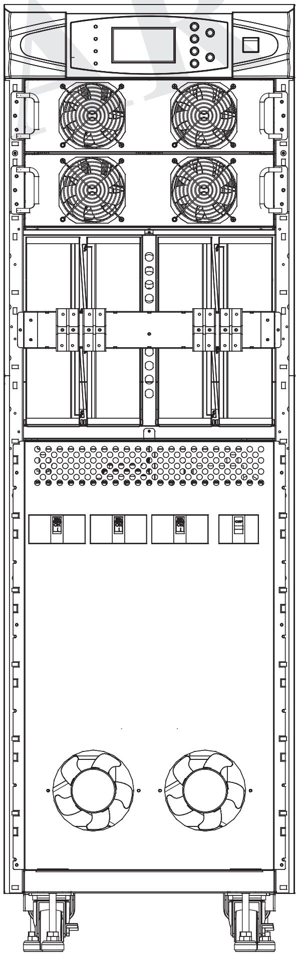


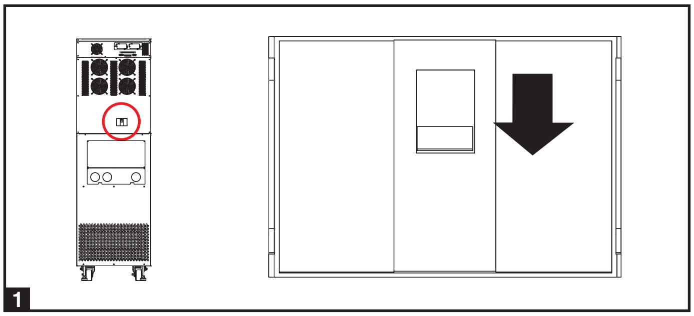
*Fig 4c Front View of SU40K*

The SU20KX model's standard battery quantity is 40, with a discharge time of about 5.5 minutes on full load. Upgrading to 80 batteries results in a discharge time of about 13 minutes on full load.

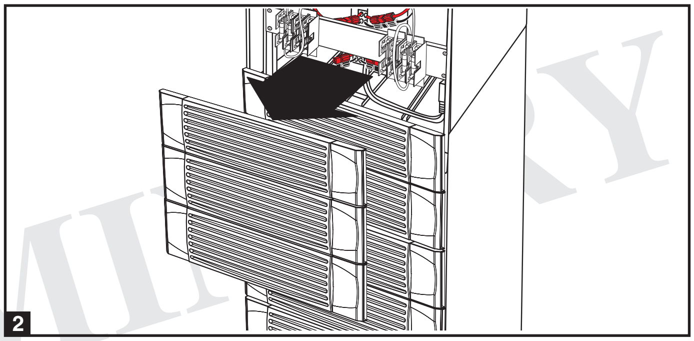
The SU40KX and SU40K (Figure 4c) model's standard battery quantity is 80, with a discharge time of about 5.5 minutes on full load.

## 4.1 Installing and Removing Internal Batteries

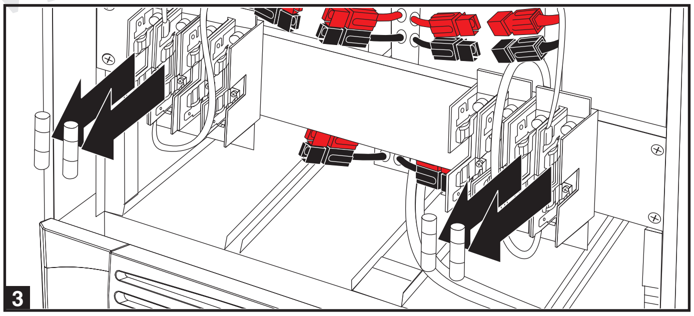
1. Place the UPS system in bypass (or turn it completely off) and turn off the internal battery circuit breaker switch, located on the rear of the UPS system.



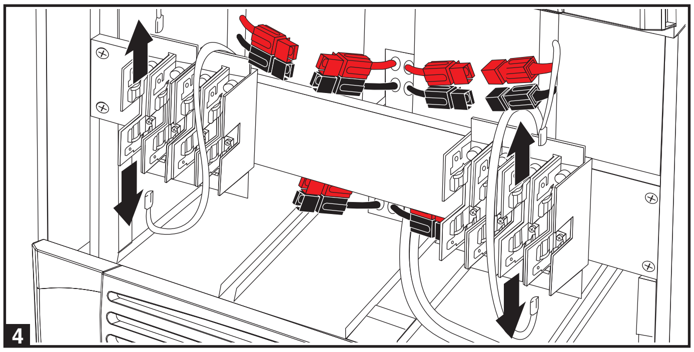
2. Remove the battery access bezels, located on the front of the UPS system.



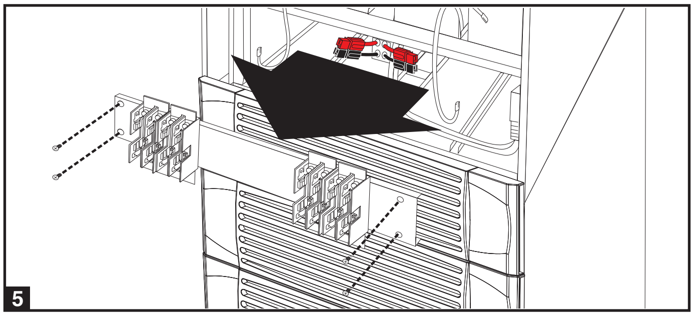
3. Remove the battery cartridge fuses from each fuse block.



4. Disconnect the blue and white jumper cables attached to each fuse block. **Warning: When disconnecting the jumper cables, pull them straight away from the fuse block with even force. Do not wiggle them side-to-side, as this may damage the connector.**

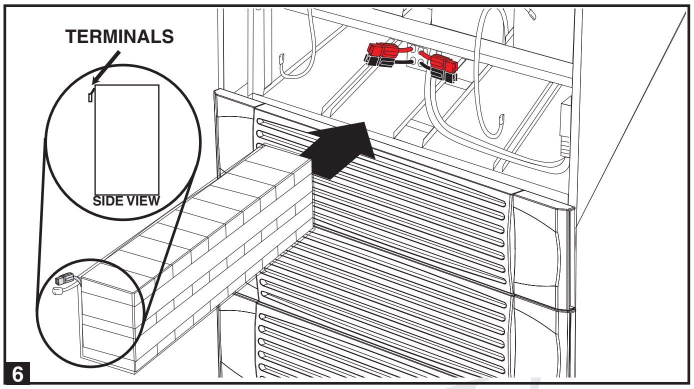


5. Remove the fuse block bracket. Note its orientation before removal.

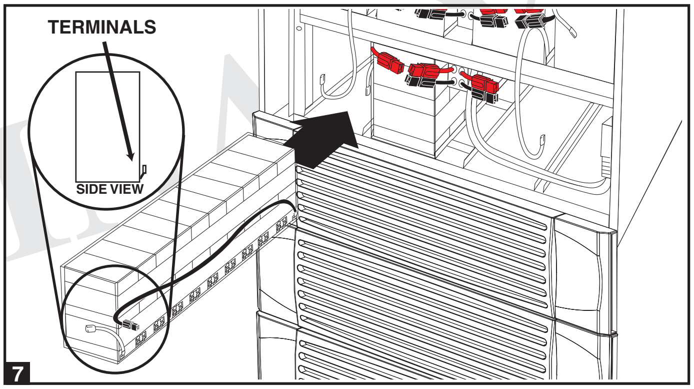


## 4.1 Installing and Removing Internal Batteries *(continued)*

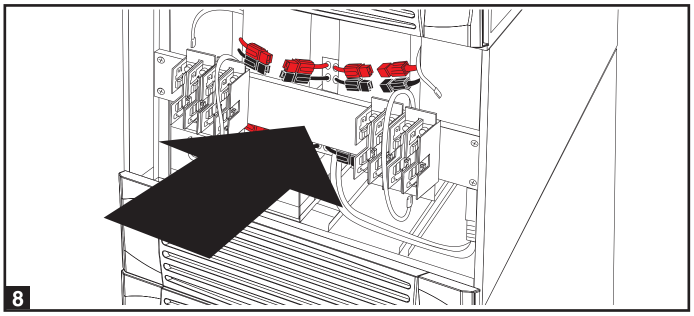
**6** Slide a battery string with a red cable into an empty slot within the battery compartment. Make sure the battery string is oriented as shown in the diagram. ***Note:*** *Start with the empty slots at the bottom of the battery compartment and work toward the empty slots at the top of the battery compartment.*



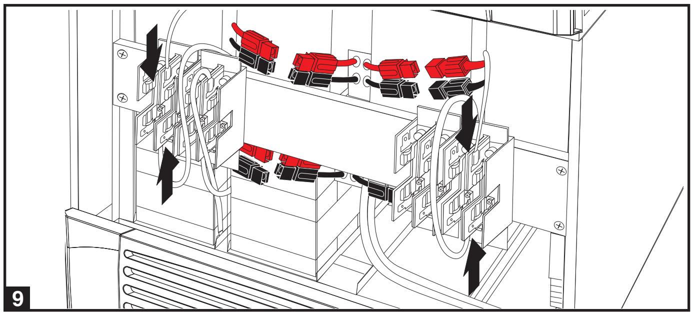
**7** Slide a battery string with a black cable into an empty slot within the battery compartment, next to the battery string that you inserted in step 6. Make sure the battery string is oriented as shown in the diagram. Repeat steps 6 and 7 as needed until all the battery strings have been inserted into the empty battery slots.



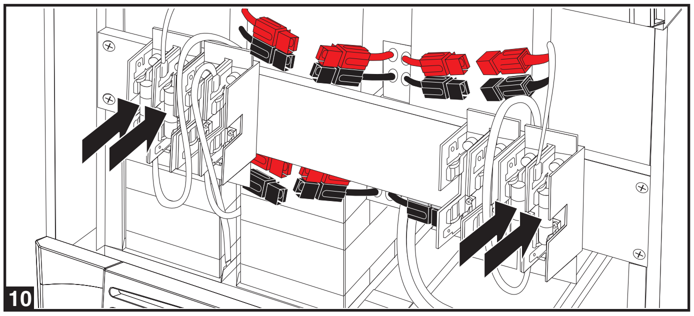
**8** Reconnect the fuse block bracket. (The letters on the fuse block bracket should be upright when it is in the correct orientation.)



**9** Connect the blue and white jumper cables on each internal battery pack to the corresponding fuse block. The labeling next to the fuse block identifies the correct fuse block for each cable.

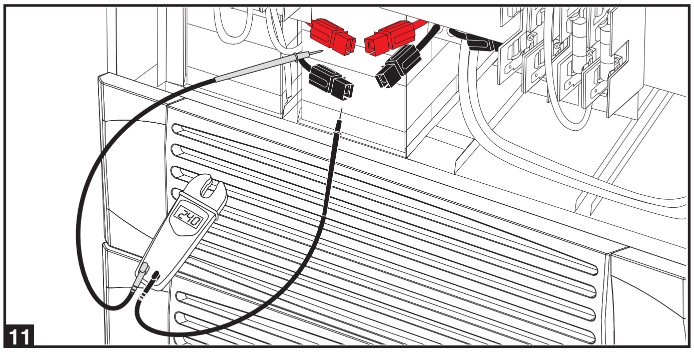


**10** Insert the battery cartridge fuses into each fuse block. The fuses are interchangeable. Make sure the fuses are firmly snapped into place. **Warning: Battery cartridge fuses must be inserted last due to potential arcing of connectors. Blown fuses must be replaced by a qualified electrician. Replace only with fuses of the same type and rating.**

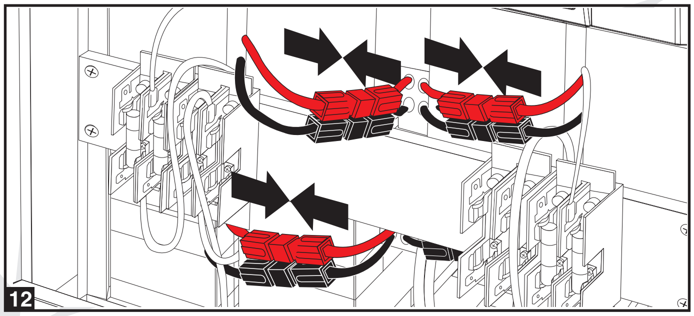


## 4.1 Installing and Removing Internal Batteries *(continued)*

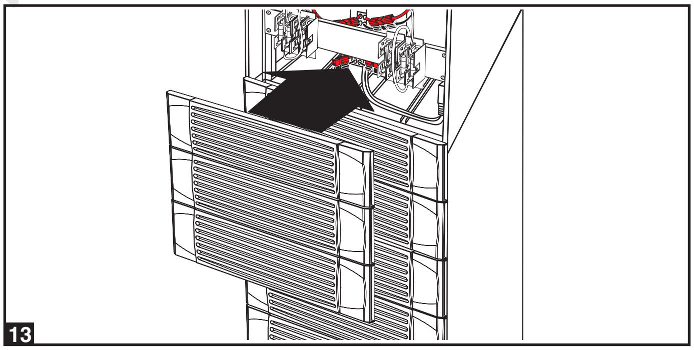
**11** Use a voltmeter (user-supplied) to test the voltage of each internal battery pack. Observing proper polarity, connect the voltmeter's **black** probe to the battery pack's **black** connector; connect the voltmeter's **red** probe to the battery pack's **red** connector. Make sure the voltmeter's probes touch the metal contacts inside the battery pack's connectors. The battery pack's acceptable DC voltage range is between 220V and 280V DC (nominal 240V DC). If several voltmeter tests yield results outside the acceptable DC voltage range, contact Tripp Lite for assistance in determining the possible causes of the incorrect voltage reading before proceeding.



**12** Connect the **black** cable for each internal battery pack to the nearest **black** connector located inside the UPS system's battery compartment. Connect the **red** cable for each internal battery pack to the nearest **red** connector located inside the UPS system's battery compartment. **Warning: Observe proper polarity by connecting negative to negative (black to black) and positive to positive (red to red). Failure to observe proper polarity will damage the UPS system and create a serious risk of personal injury and property damage.**



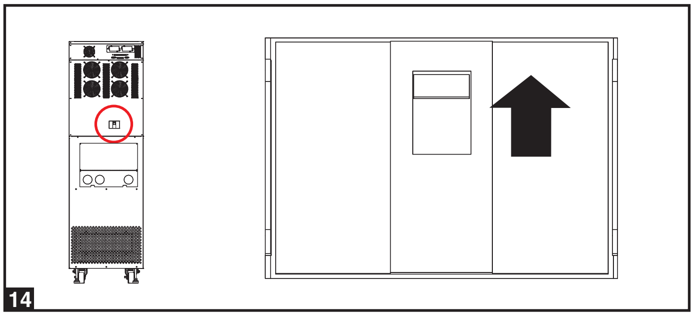
**13** Replace the battery access bezels.



PRELIM

**14** Turn on the internal battery circuit breaker switch. If you placed the UPS system in bypass, return it to the previous operating mode. If you turned the UPS system off, turn it on.

***Note:*** *If you need to remove or replace internal battery packs, modify steps 6 and 7 by removing and/or replacing the existing internal battery packs, as required.*



## 4.2 Battery Cabinet

The standard battery cabinet includes two models: BP480V26B (Figure 4.2a) and BP480V40C (Figure 4.2b). (See Table 4.2a for battery cabinet weight and floor loading)

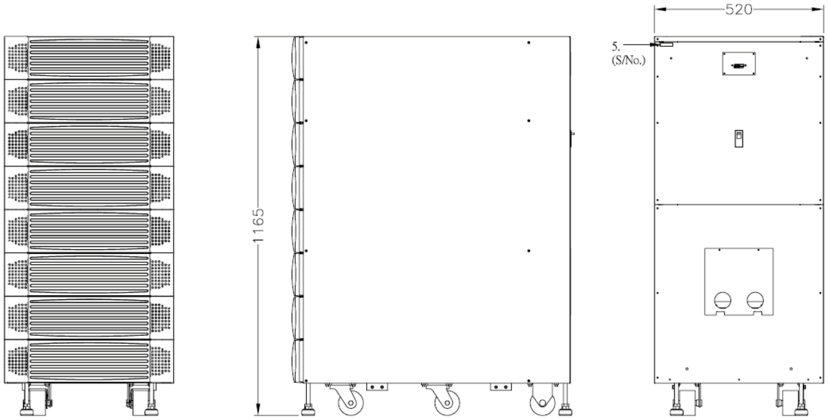


*Fig 4.2a BP480V26B*

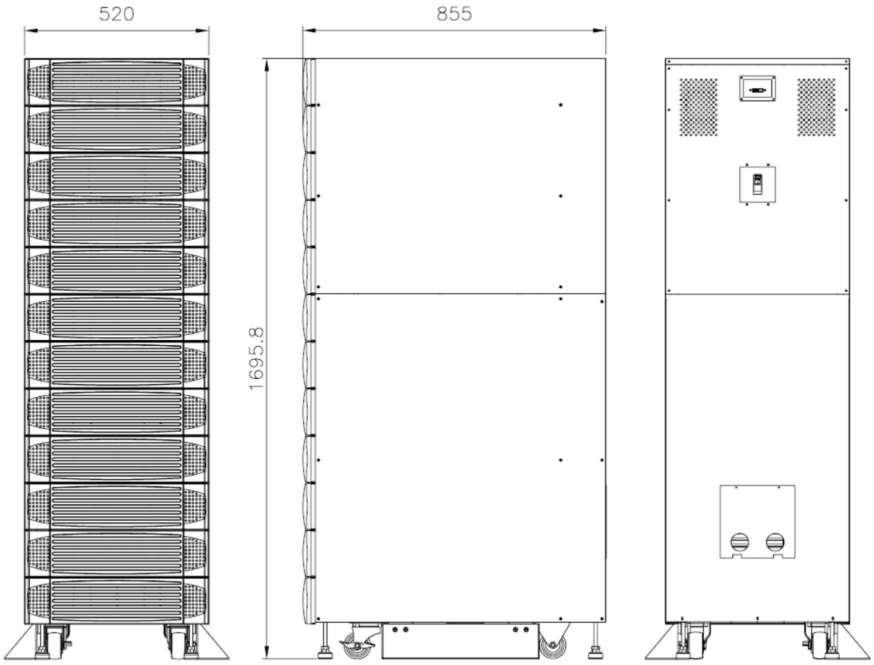


*Fig 4.2b BP480V40C*

**Table 4.2a**

| | BP480V26B | BP480V40C |
|---|---|---|
| **Weight** | 470 kg | 700 kg |
| **Floor Loading** | 1064 kg/m^2 | 1575 kg/m^2 |
| **Battery Capacity** | 40 | 40 |
| **Voltage** | 12V DC | 12 V DC |
| **Amp/Hour** | 26AH | 40AH |
| **Battery Type** | VRLA | VRLA |

## 4.2 Battery Cabinet *(continued)*

Both battery cabinet models have a Q board installed on the rear (Figure 4.2c).

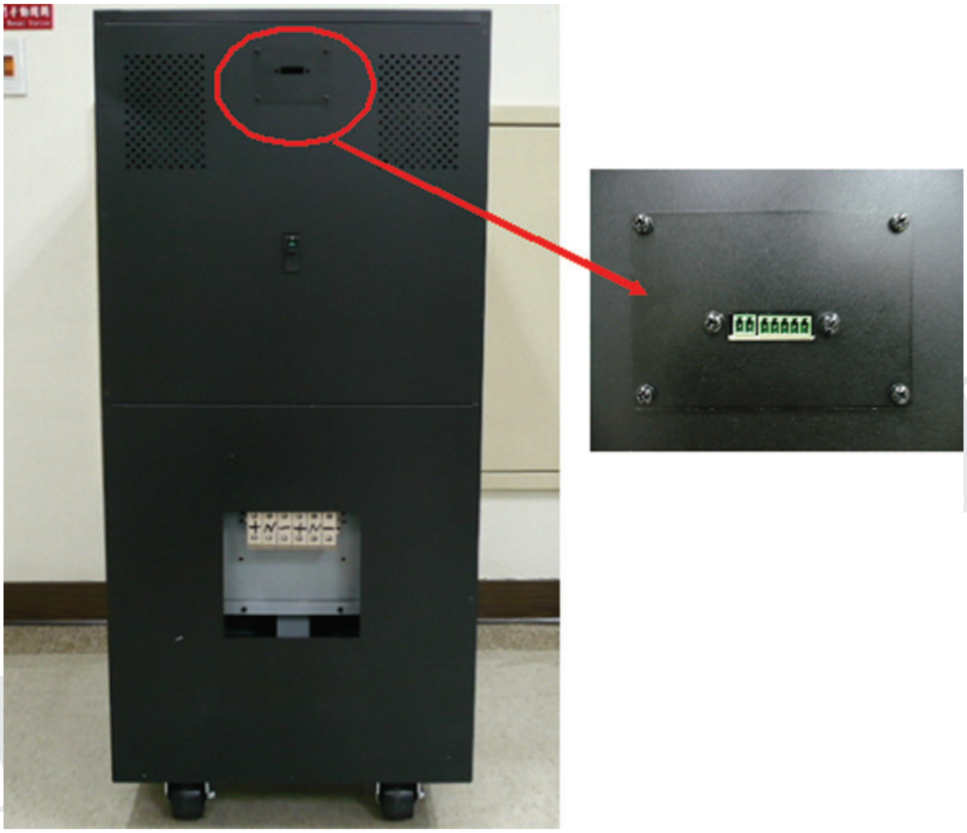


*Fig 4.2c*

Q board functions include:

- Battery temperature detection: The UPS detects the temperature of the battery cabinet and compensates the battery voltage.
- Battery circuit breaker status detection: When this breaker is tripped, the UPS can detect its status and display an alarm message on the LCD.

## 4.2 Battery Cabinet *(continued)*

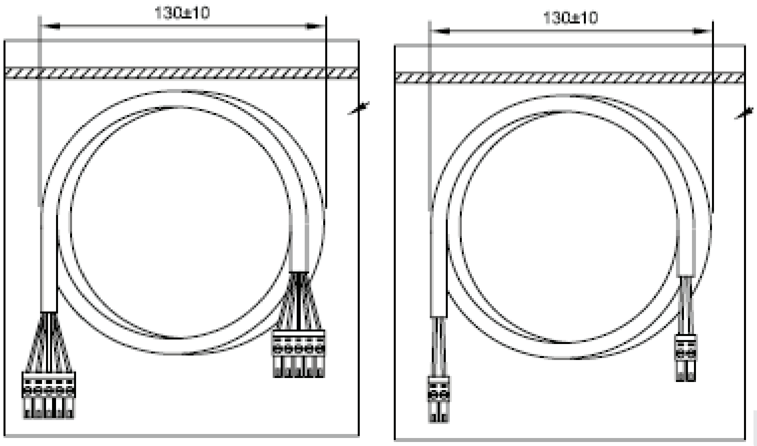

130±10
130±10

*Fig 4.2d W1 and W2 Cables*

To connect the external battery cabinet to its UPS system, use the W1 and W2 cables (Figure 4.2d) to connect the Q boards (Figure 4.2e) using the ports illustrated (Figure 4.2f).

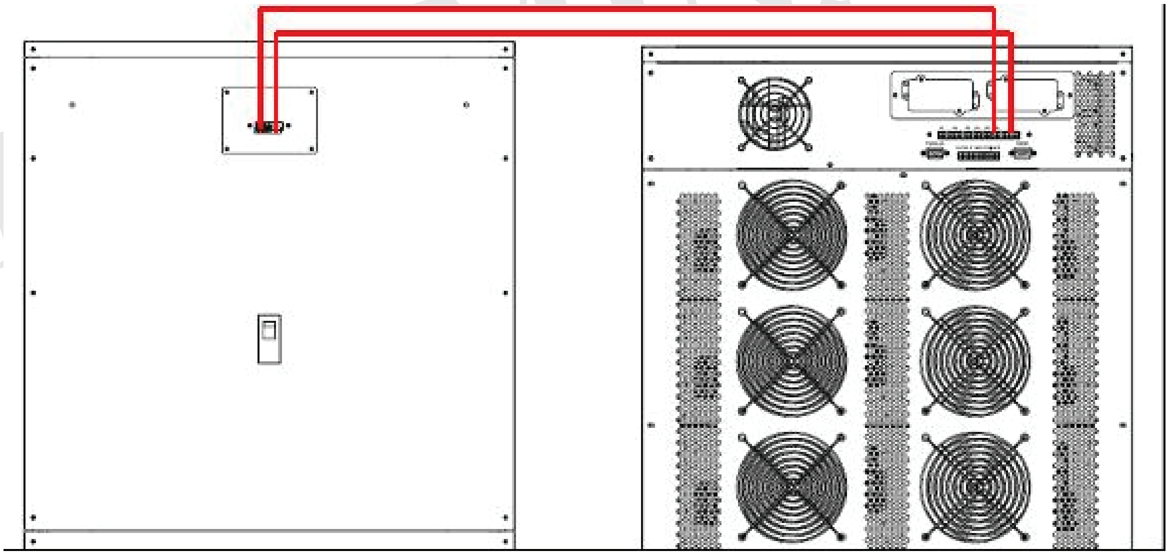


*Fig 4.2e Connection between UPS and Battery Cabinet*

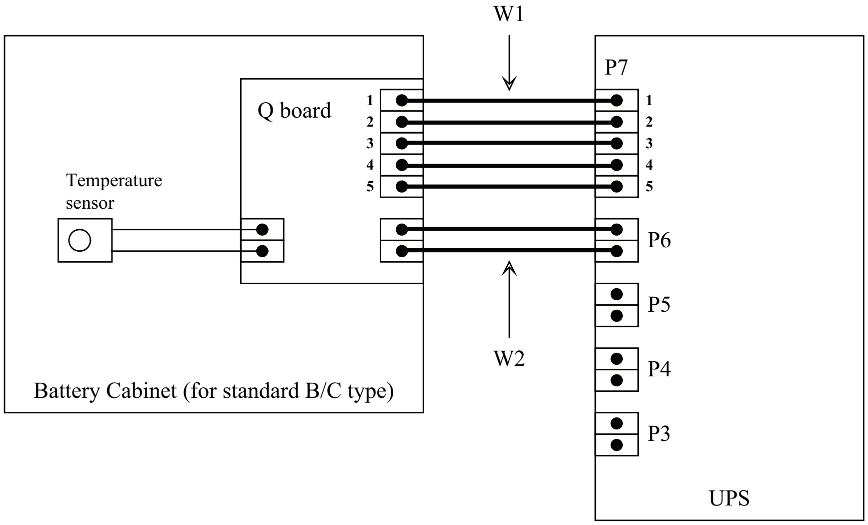

W1
Q board
1
2
3
4
5
Temperature sensor
P7
1
2
3
4
5
P6
P5
W2
P4
P3
Battery Cabinet (for standard B/C type)
UPS

*Fig 4.2f Wiring between UPS and Battery Cabinet*

# 5 Troubleshooting

## 5.1 Alarm Messages

Alarm messages are displayed on the LCD control panel. Press the “UP” and “DOWN” buttons to scroll through all alarm messages.

**Table 5.1a Warning Message List**

| Warning Message | Condition | Chapter Index |
|---|---|---|
| MAIN VOLT/FREQ NOK | Main input voltage abnormal<br>( load<70%: 120V~276V, load>70%:173V~276V )<br>Main input Freq. abnormal ( 45Hz~65Hz ) | 5.2.1 |
| MAIN SEQUENCE NOK | Main input phase sequence abnormal | 5.2.2 |
| BYPASS VOLT/REQ NOK | Bypass voltage over rating<br>( 220V/230V/240V ) +/-15%<br>Bypass Freq. over rating ( 50Hz/60Hz )+/-5Hz | 5.2.3 |
| BYPASS SEQUENCE NOK | Bypass phase sequence abnormal | 5.2.4 |
| BYPASS STATIC SWITCH OVER TEMPERATURE | Bypass STS temperature over 80 degree C | 5.2.5 |
| BYPASS STATIC SWITCH FAULT | Bypass STS open/short | 5.2.6 |
| BYPASS STATIC SWITCH OVERLOAD | Bypass loading over 175% | 5.2.7 |
| UPS INTERNAL COMM ABNORMAL | 1.CAN BUS loss<br>2.SCI loss<br>3.Power module internal communication loss | 5.2.8 |
| BAT TEST FAIL | Battery Capacity too low | 5.2.9 |
| BAT OVER CHARGE | Battery voltage more than 296V | 5.2.10 |
| BATTERY BAD | Battery Voltage under 190V | 5.2.11 |
| BYPASS FAN FAILURE | Bypass FanA/B/C fail | 5.2.12 |
| TRANSFORMER OVERHEAT | IN/OUT transformer overheat warning (HW detect signal) | 5.2.13 |
| UPS OUTPUT VOLT NOK | UPS output voltage over rating<br>( 220V/230V/240V ) +/-10V | 5.2.14 |
| UPS EXT PARALLEL COMM ABNORMAL | Parallel CAN BUS loss | 5.2.15 |
| PARALLEL FAILURE | PID conflict or system KVA rating not the same | 5.2.16 |
| REDUNDANCY LOSS | UPS lost redundancy | 5.2.17 |
| MANUAL BYPASS ON | Manual bypass on | |
| BAT LOW WARNING | Battery voltage under 220V and above 200V | |
| BAT LOW SHUTDOWN | Battery voltage under 200V | |
| BAT REPLACE REQUIRED | Battery package out of date | |
| INVERTER OVERLOAD WARNING | Loading over 105% | |
| INVERTER OVERLOAD SHUTDOWN | Loading over 105%~125% 10min.<br>Loading over 125%~150% 1min.<br>Loading over 150% 1sec. | |
| INVERTER OVER CURRENT | Output current over 80A/phase | |
| EMERGENCY POWER OFF ACTIVED | E.P.O./ Remote E.P.O. ON | |
| OUTPUT BREAKER OFF | Output breaker not turn on | |
| BYPASS LOAD OVER 104% | the load over 104% when UPS is on bypass | |
| BAT CABINET OVER TEMPERATURE | Battery cabinet over 35 degree C | |
| EXT BAT BREAKER OFF | If support external battery and the breaker ont turn on | |

## 5.1 Alarm Messages *(continued)*

Alarm messages are displayed on the LCD control panel. Press the “UP” and “DOWN” buttons to scroll through all alarm messages.

**Table 5.1b Power Module Warning Message List**

| Warning Message | Condition |
|---|---|
| PWR MODULE #n PFC FUSE OPEN | Power module #n main input fuse broken |
| PWR MODULE #n INVERTER FUSE OPEN | Power module #n output fuse broken |
| PWR MODULE #n GENERAL FAULT | PFC/INV control board fail |
| PWR MODULE #n CHARGER FAILURE | Power module #n charger board fail |
| PWR MODULE #n FAN FAILURE | Power module #n fan(s) fail |
| PWR MODULE #n PFC OVER TEMPERATURE WARNING | Power module #n PFC temperature over 60 degree C |
| PWR MODULE #n PFC OVER TEMPERATURE SHUTDOWN | Power module #n PFC temperature over 65 degree C |
| PWR MODULE #n INVERTER WARNING OVER TEMPERATURE | Power module #n INV temperature over 60 degree C |
| PWR MODULE #n INVERTER SHUTDOWN OVER TEMPERATURE | Power module #n INV temperature over 65 degree C |
| PWR MODULE #n INVERTER VOLT NOK | Power module #n INV voltage over rating ( 220V/230V/240V ) +/-1% |
| PWR MODULE #n INVERTER SHORT CIRCUIT | UPS output short circuit |
| PWR MODULE #n STATIC SWITCH FAULT | Power module #n STS open/short |
| PWR MODULE #n DC BUS ABNORMAL | Power module #n DC BUS over 430V / under 300V |

***Note:*** *#n indicates the ID of the power module. (Ex.: #1 is power module 1)*

***Note:*** *In the event of power module failure, refer to chapter 6.1.*

## 5.2 Troubleshooting Flow Charts

### 5.2.1 “MAIN VOLT/FREQ NOK”

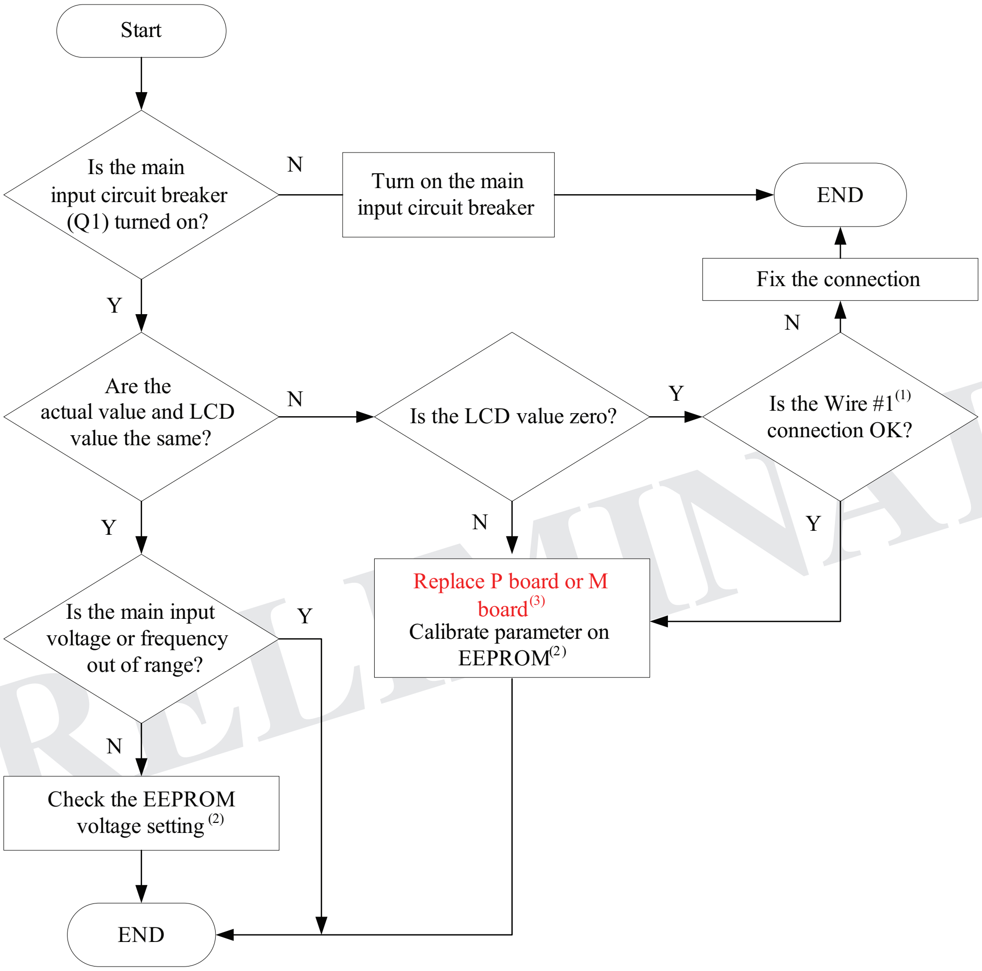

Start
Is the main input circuit breaker (Q1) turned on?
N
Turn on the main input circuit breaker
END
Fix the connection
N
Y
Are the actual value and LCD value the same?
N
Is the LCD value zero?
Y
Is the Wire #1(1) connection OK?
Y
N
Y
Replace P board or M board(3)
Calibrate parameter on EEPROM(2)
Is the main input voltage or frequency out of range?
Y
N
Check the EEPROM voltage setting (2)
END

*Fig 5.2.1a*

***Note (1):*** *For SU20KX, SU40KX and SU40K models, wire #1 is connected between the P board (CNP7) and FA (CNA9) for main input. (See chapter 1.5.) For SU60KX, SU80KX, SU60K, SU80K, SU60KTV and SU80KTV, wire #1 is connected between the P board (CNP7) and F1 (CNF15) for main input. (See section 1.5.)*

***Note (2):*** *To learn about EEPROM parameter settings and calibration, turn to section 3.2.*

***Note (3):*** *For the location of the NHS-SYS-P and NHS-SYS-M boards, turn to section 1.5. To replace the NHS-SYS-M board, simply remove the EEPROM chip from an old NHS-SYS-M board and insert it into the new one.*

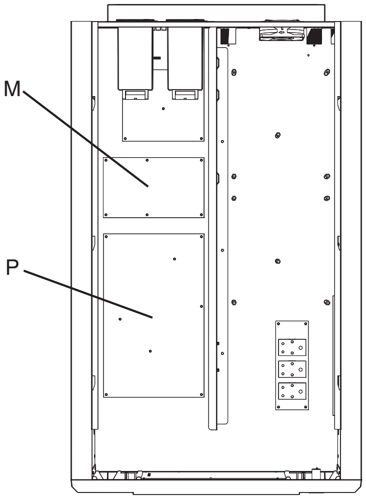


*Fig 5.2.1b*

## 5.2 Troubleshooting Flow Charts *(continued)*

### 5.2.2 "MAIN SEQUENCE NOK"

This may occur during startup or if the customer changes their charger generation or main input source improperly.

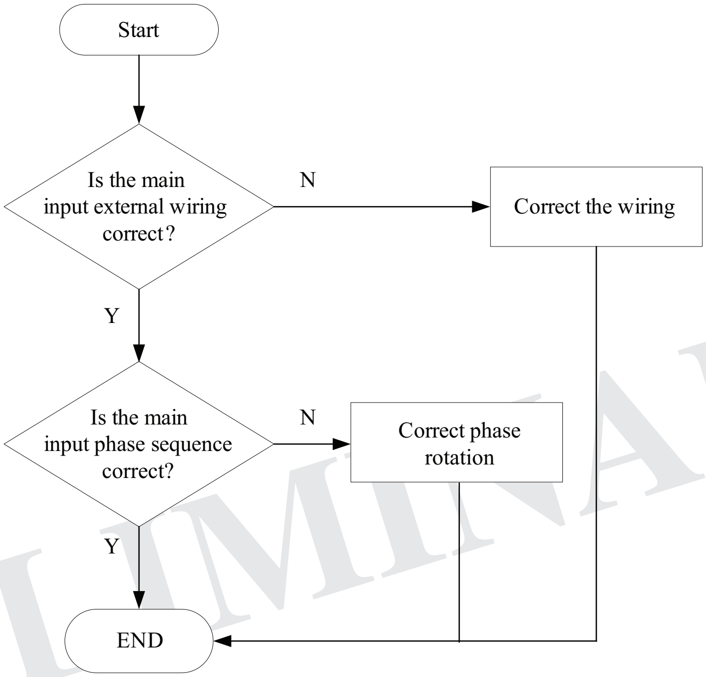

Start
Is the main input external wiring correct?
N
Correct the wiring
Y
Is the main input phase sequence correct?
N
Correct phase rotation
Y
END

*Fig 5.2.2a*

## 5.2 Troubleshooting Flow Charts *(continued)*

### 5.2.3 “BYPASS VOLT/FREQ NOK”

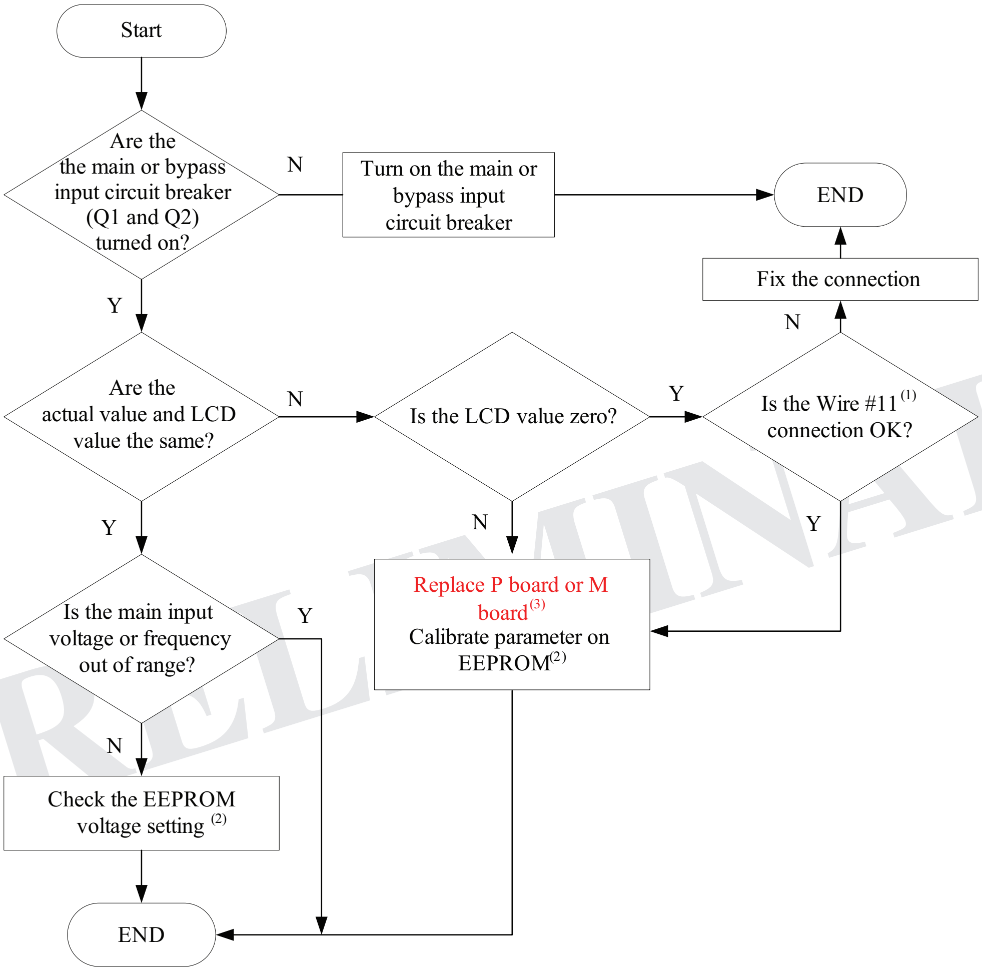

Start
Are the the main or bypass input circuit breaker (Q1 and Q2) turned on?
N
Turn on the main or bypass input circuit breaker
END
Fix the connection
N
Y
Are the actual value and LCD value the same?
N
Is the LCD value zero?
Y
Is the Wire #11 (1) connection OK?
Y
N
Y
Is the main input voltage or frequency out of range?
Y
Replace P board or M board (3)
Calibrate parameter on EEPROM (2)
N
Check the EEPROM voltage setting (2)
END

*Fig 5.2.3a*

***Note (1):*** *For SU20KX, SU40KX and SU40K models, wire #11 is connected between P board (CNP8) and FA (CNA9) for bypass input. (See chapter 1.5.) For SU60KX, SU80KX, SU60K, SU80K, SU60KTV and SU80KTV, wire #11 is connected between P board (CNP8) and F1 (CNF15) for bypass input. (For locations, see chapter 1.7)*

***Note (2):*** *To learn about EEPROM parameter settings and calibration, turn to chapter 3.2.*

***Note (3):*** *For the location of the NHS-SYS-P and NHS-SYS-M boards, turn to chapter 1.5. To replace the NHS-SYS-M board, simply remove the EEPROM chip from an old NHS-SYS-M board and insert it into the new one.*

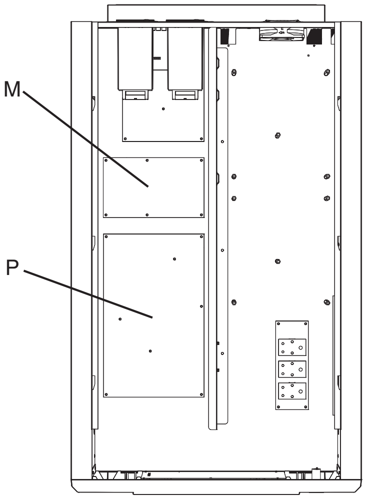


*Fig 5.2.3b*

## 5.2 Troubleshooting Flow Charts *(continued)*

### 5.2.4 "BYPASS SEQUENCE NOK"

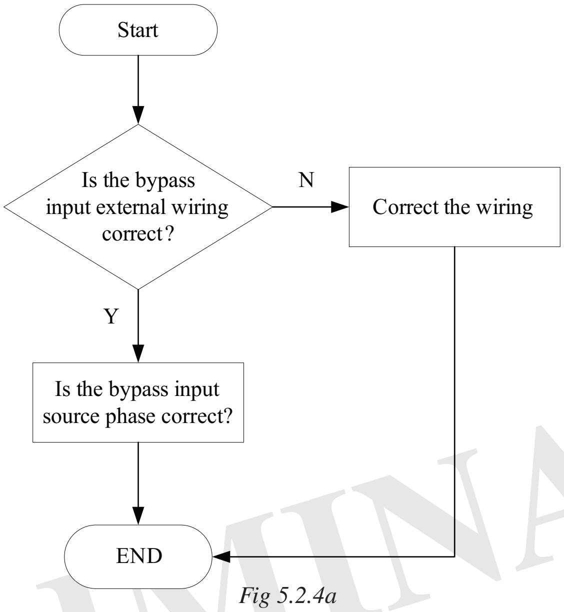

Start
Is the bypass input external wiring correct?
N
Correct the wiring
Y
Is the bypass input source phase correct?
END

*Fig 5.2.4a*

### 5.2.5 "BYPASS STATIC SWITCH OVER TEMPERATURE"

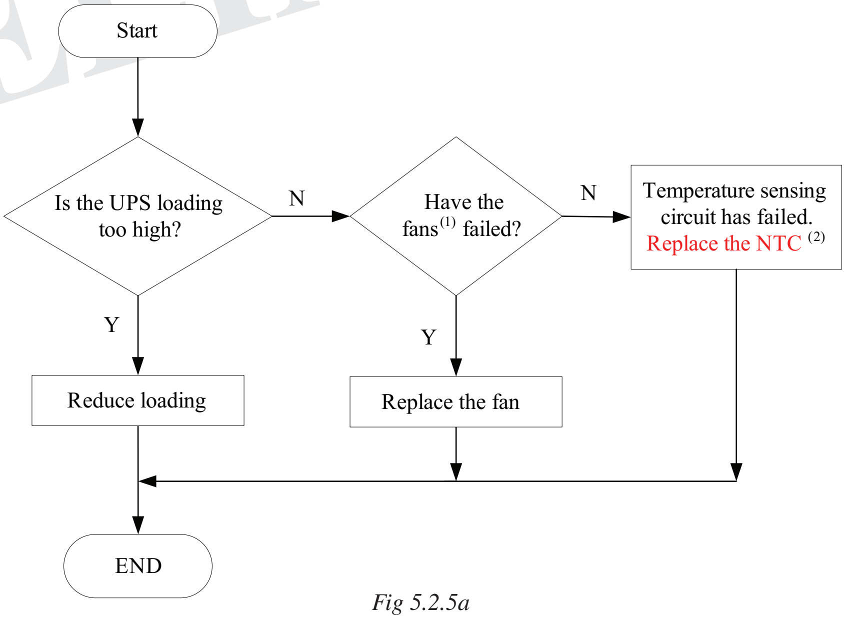

Start
Is the UPS loading too high?
N
Have the fans(1) failed?
N
Temperature sensing circuit has failed.
Replace the NTC (2)
Y
Reduce loading
Y
Replace the fan
END

*Fig 5.2.5a*

**Note (1):** *The fans are installed at the heat-sink of the bypass static switch. (See section 1.5)*

**Note (2):** *The NTC is mounted on the heat-sink of bypass static switch (Figure 5.2.5b). Remove wire #35 and unscrew the NTC.*

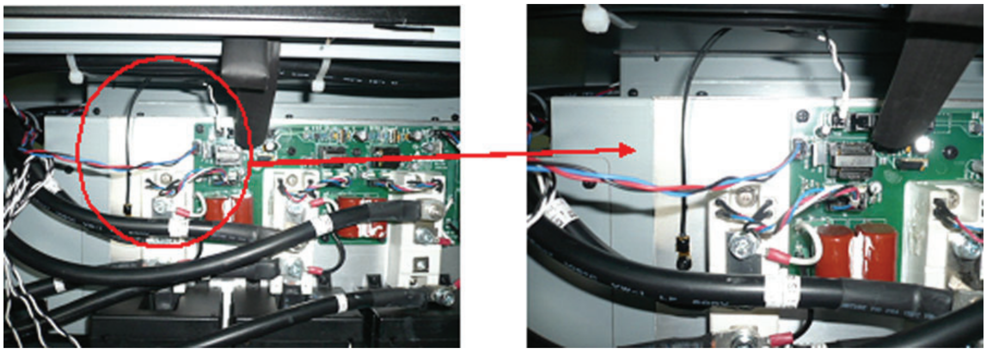


*Fig 5.2.5b*

## 5.2 Troubleshooting Flow Charts *(continued)*

### 5.2.6 "BYPASS STATIC SWITCH FAULT"

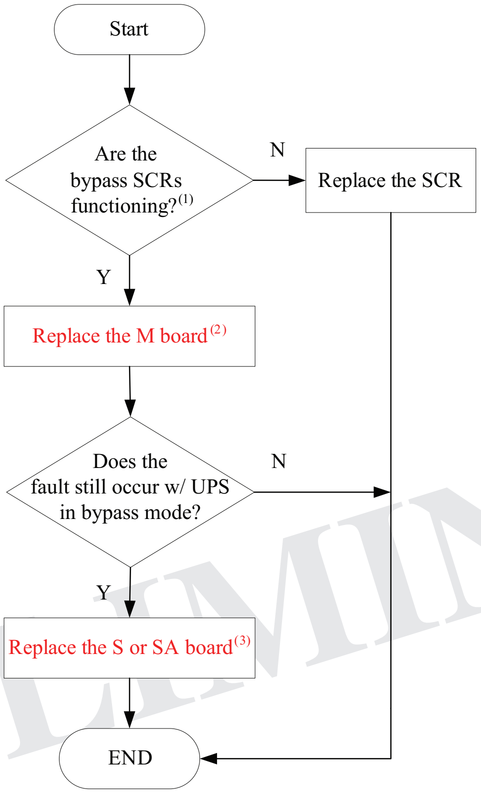

Start
Are the bypass SCRs functioning?(1)
N
Replace the SCR
Y
Replace the M board (2)
Does the fault still occur w/ UPS in bypass mode?
N
Y
Replace the S or SA board (3)
END

*Fig 5.2.6a*

***Note (1):*** *Use a multimeter to measure the pins of bypass SCRs. If the ohm value is close to zero, it indicates that the SCR has failed. (For the location of bypass SCRs, turn to section 1.5)*

***Note (2):*** *For the location of the NHS-SYS-M board, turn to section 1.5. To replace the NHS-SYS-M board, remove the EEPROM chip from the old NHS-SYS-M board and insert it into the new one.*

***Note (3):*** *For the location of the NHS-SYS-S board (for 60kVA and 80kVA) or the NHS-SYS-SA board (for 20kVA and 40kVA), turn to section 1.5.*

### 5.2.7 "BYPASS STATIC SWITCH OVERLOAD"

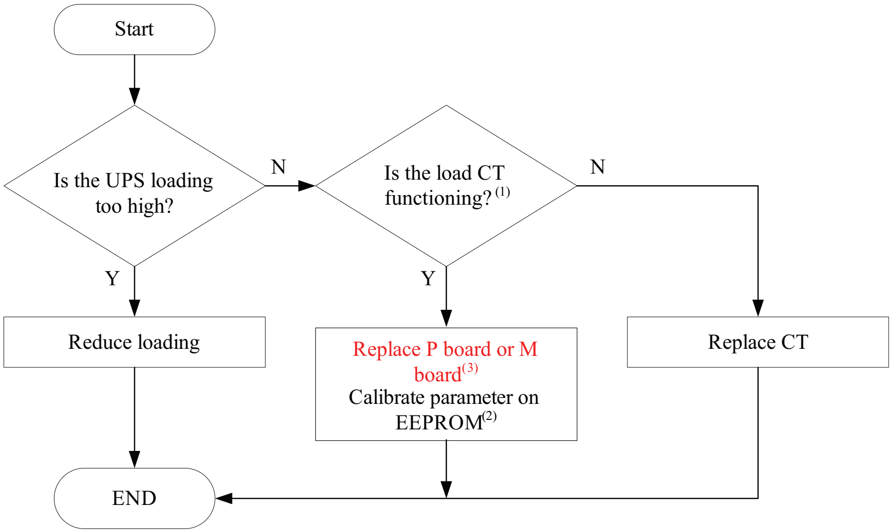

Start
Is the UPS loading too high?
N
Is the load CT functioning? (1)
N
Y
Y
Reduce loading
Replace P board or M board(3)
Calibrate parameter on EEPROM(2)
Replace CT
END

*Fig 5.2.7a*

***Note (1):*** *Use a multimeter to measure OIP CT resistance. If the value is about 35ohm, the OIP CT is good.*

***Note (2):*** *To learn about EEPROM parameter settings and calibration, turn to section 3.2.*

***Note (3):*** *To learn the location of the NHS-SYS-P and NHS-SYS-M boards, turn to section 1.5. To replace the NHS-SYS-M board, remove the EEPROM chip from the old NHS-SYS-M board and insert it into the new one.*

### 5.2.8 "UPS INTERNAL COMM ABNORMAL"

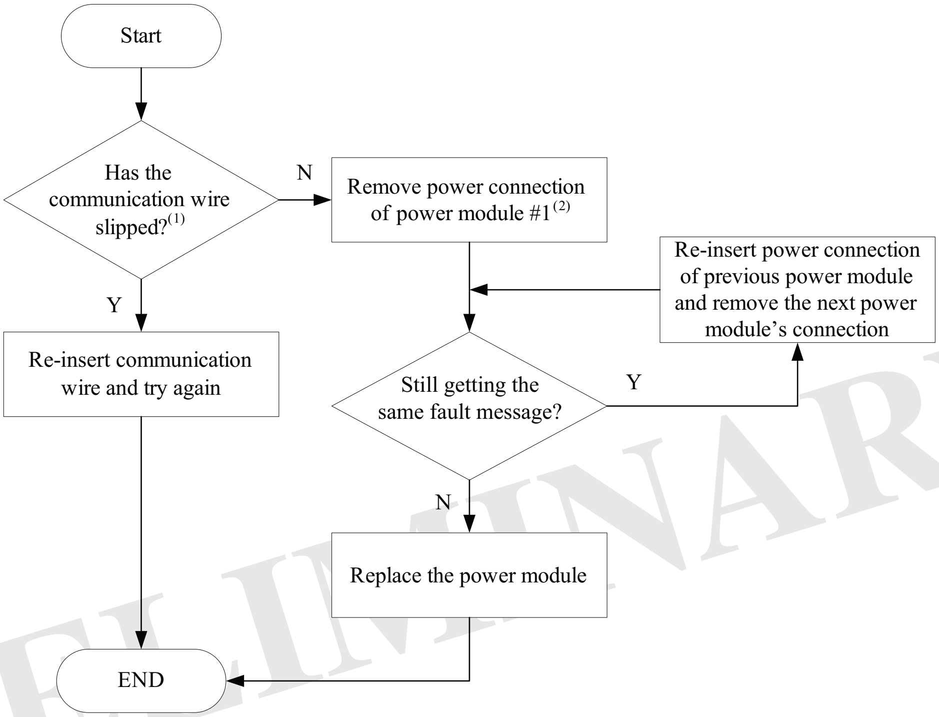

Start
Has the communication wire slipped?(1)
N
Remove power connection of power module #1(2)
Re-insert power connection of previous power module and remove the next power module's connection
Y
Re-insert communication wire and try again
Still getting the same fault message?
Y
N
Replace the power module
END

*Fig 5.2.8a*

***Note (1):*** *Check W2A, W2B, W2C, W2D, W4A, W4B and W6 (Fig 5.2.8b).*

***Note (2):*** *Remove wires W61A, W65A and W68A.*

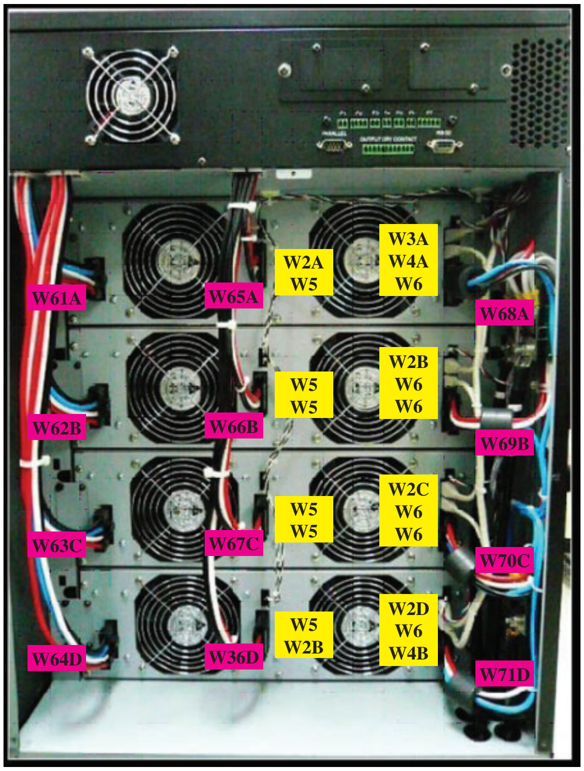

W61A
W65A
W2A
W5
W3A
W4A
W6
W68A
W62B
W66B
W5
W5
W2B
W6
W6
W69B
W63C
W67C
W5
W5
W2C
W6
W6
W70C
W64D
W36D
W5
W2B
W2D
W6
W4B
W71D

*Fig 5.2.8b*

## 5.2 Troubleshooting Flow Charts *(continued)*

### 5.2.9 "BATTERY TEST FAIL"

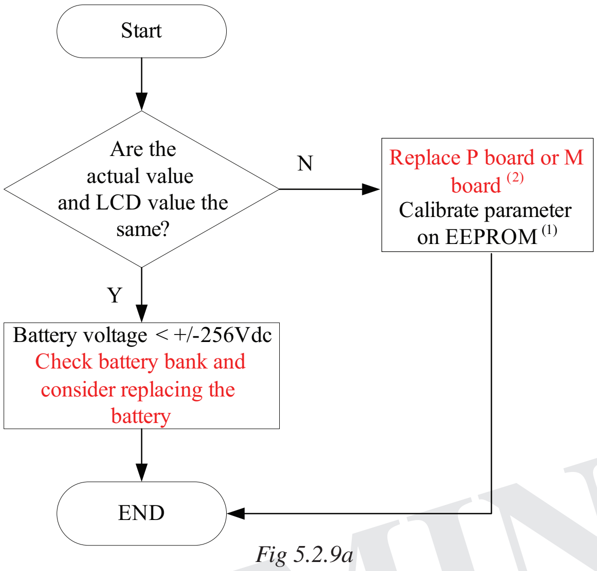

Start
Are the actual value and LCD value the same?
N
Replace P board or M board (2)
Calibrate parameter on EEPROM (1)
Y
Battery voltage < +/-256Vdc
Check battery bank and consider replacing the battery
END

*Fig 5.2.9a*

**Note (1):** *To learn about EEPROM parameter settings and calibration, turn to section 3.2.*

**Note (2):** *For the location of the NH-SYS-P and/or NH-SYS-M board, turn to section 1.5. To replace the NHS-SYS-M board, remove the EEPROM chip from the old NHS-SYS-M board and insert it into the new one.*

### 5.2.10 "BATTERY OVER CHARGE"

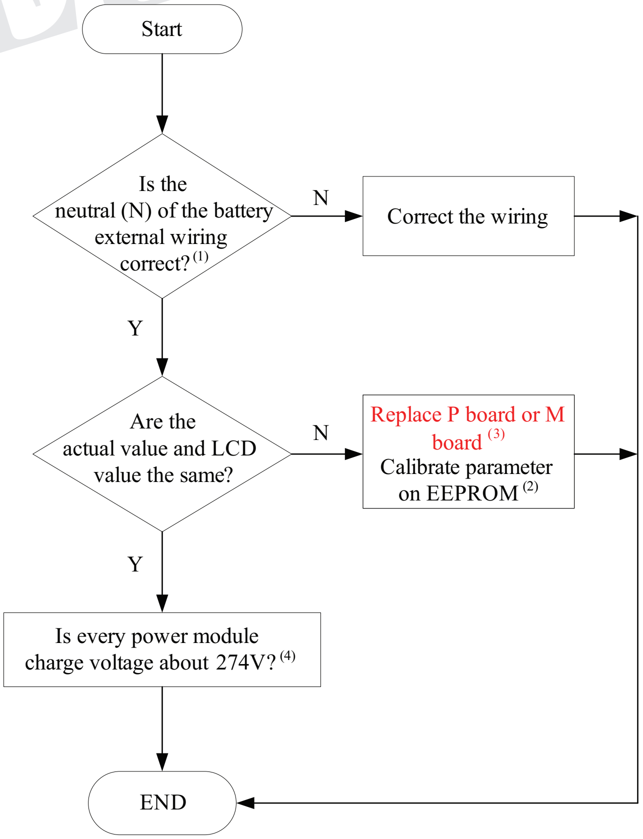

Start
Is the neutral (N) of the battery external wiring correct? (1)
N
Correct the wiring
Y
Are the actual value and LCD value the same?
N
Replace P board or M board (3)
Calibrate parameter on EEPROM (2)
Y
Is every power module charge voltage about 274V? (4)
END

*Fig 5.2.10a*

**Note (1):** *The midpoint of the battery string must be connected to the neutral (N) of the battery terminal block.*

**Note (2):** *To learn about EEPROM parameter settings and calibration, turn to section 3.2.*

**Note (3):** *For the location of the NH-SYS-P and/or NH-SYS-M board, turn to section 1.5. To replace the NHS-SYS-M board, remove the EEPROM chip from the old NHS-SYS-M board and insert it into the new one.*

**Note (4):** *Check the battery voltage of each power module one at a time. If it is normal, check the next one.*

## 5.2 Troubleshooting Flow Charts *(continued)*

### 5.2.11 "BATTERY BAD"

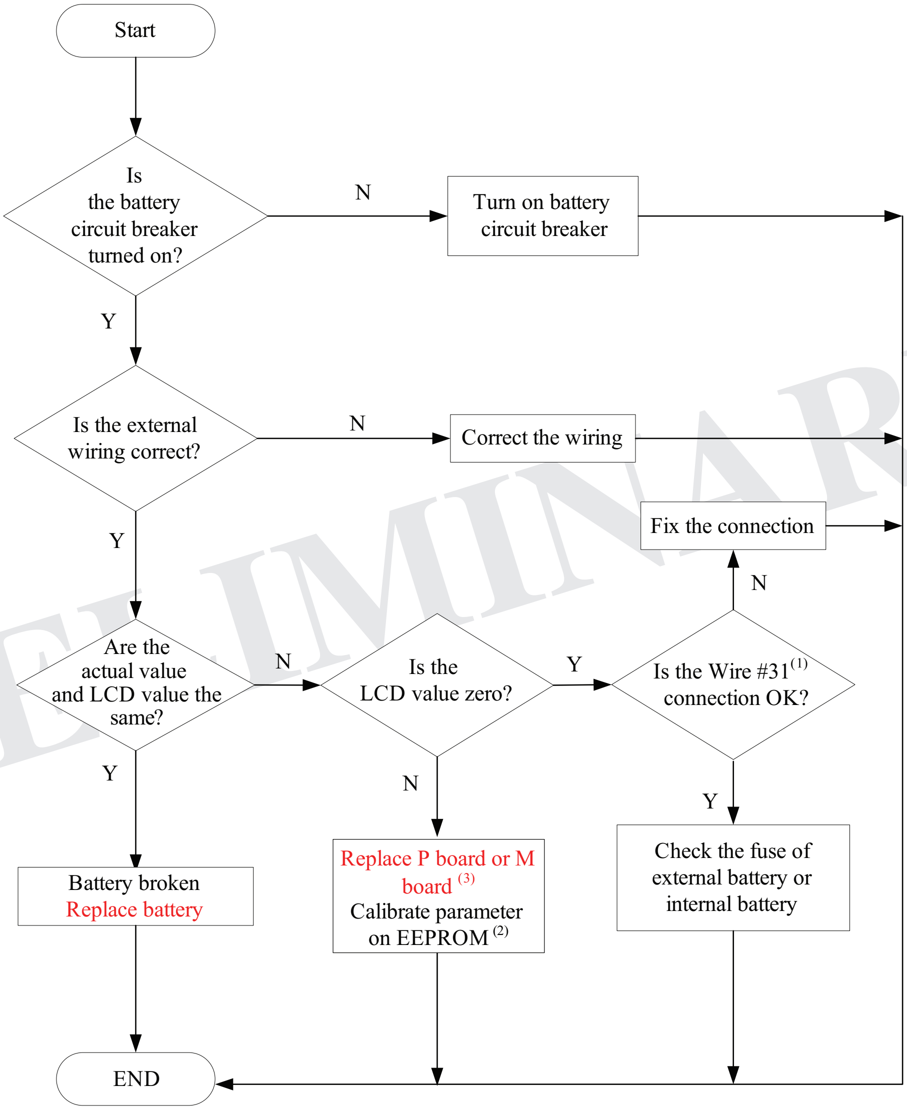

Start
Is the battery circuit breaker turned on?
N
Turn on battery circuit breaker
Y
Is the external wiring correct?
N
Correct the wiring
Y
Fix the connection
N
Are the actual value and LCD value the same?
N
Is the LCD value zero?
Y
Is the Wire #31(1) connection OK?
Y
N
Y
Battery broken
Replace battery
Replace P board or M board (3)
Calibrate parameter on EEPROM (2)
Check the fuse of external battery or internal battery
END

*Fig 5.2.11a*

***Note (1):*** *Wire #31 connects CNP10 on the NH-SYS-P board to CNB7 on the NH-SYS-B board (Figure 5.2.11b).*

***Note (2):*** *To learn about EEPROM parameter settings and calibration, turn to section 3.2.*

***Note (3):*** *For the location of the NH-SYS-P and/or NH-SYS-M board, turn to section 1.5. To replace the NHS-SYS-M board, remove the EEPROM chip from the old NHS-SYS-M board and insert it into the new one.*

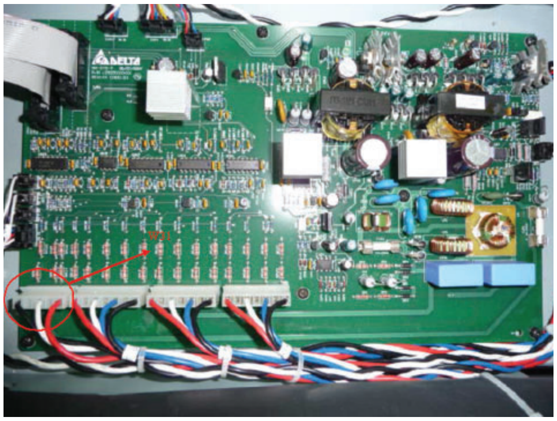


*Fig 5.2.11b*

## 5.2 Troubleshooting Flow Charts *(continued)*

### 5.2.12 "BYPASS FAN FAILURE"

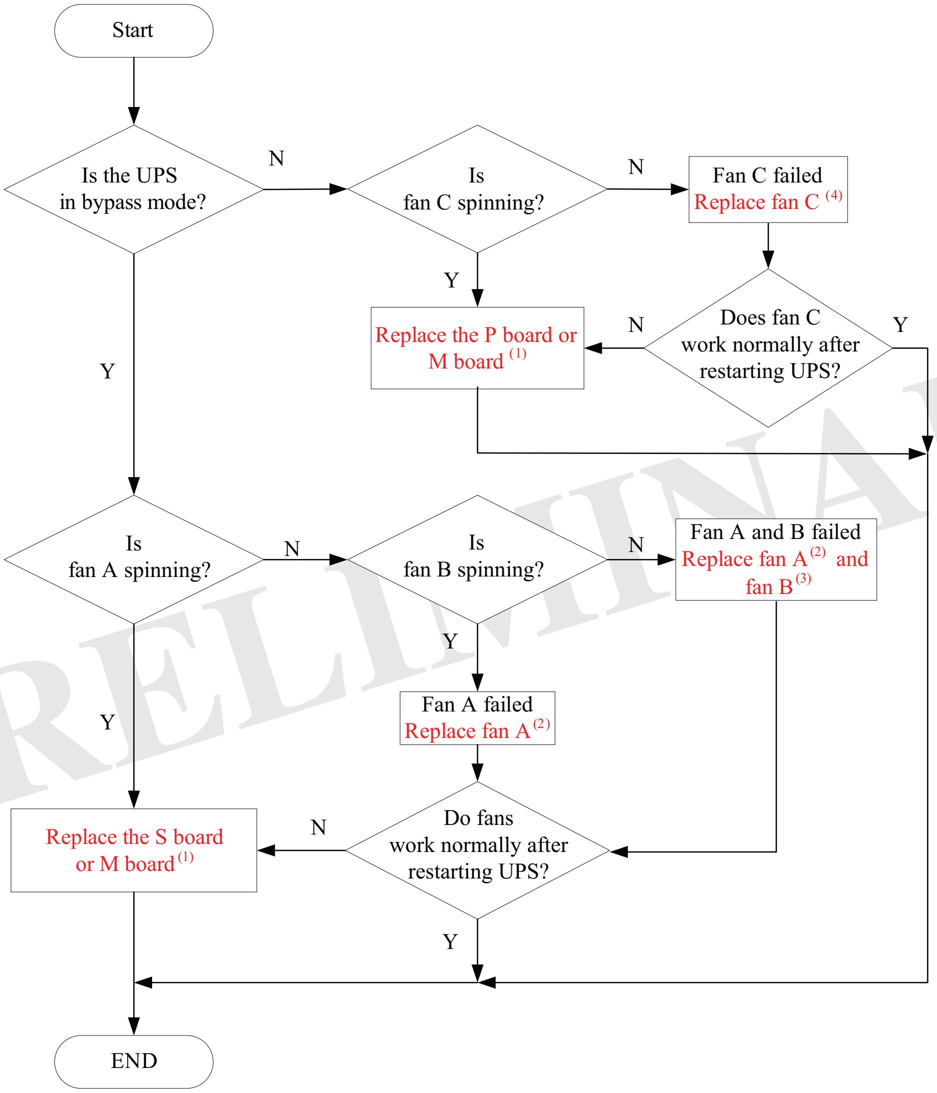

Start
Is the UPS in bypass mode?
N
Is fan C spinning?
N
Fan C failed
Replace fan C (4)
Y
Replace the P board or M board (1)
N
Does fan C work normally after restarting UPS?
Y
Y
Is fan A spinning?
N
Is fan B spinning?
N
Fan A and B failed
Replace fan A (2) and fan B (3)
Y
Fan A failed
Replace fan A (2)
Y
Replace the S board or M board (1)
N
Do fans work normally after restarting UPS?
Y
END

*Fig 5.2.12a*

***Note (1):*** *For the location of the NH-SYS-P and/or NH-SYS-M board, turn to section 1.5. To replace the NHS-SYS-M board, remove the EEPROM chip from the old NHS-SYS-M board and insert it into the new one.*

***Note (2):*** *Fan A is the main fan for the bypass static switch (Figure 5.2.12b).*

***Note (3):*** *Fan B is the redundancy fan for the bypass static switch (Figure 5-16).*

***Note (4):*** *Fan C is the main fan for the filter (Figure 5.2.12c).*

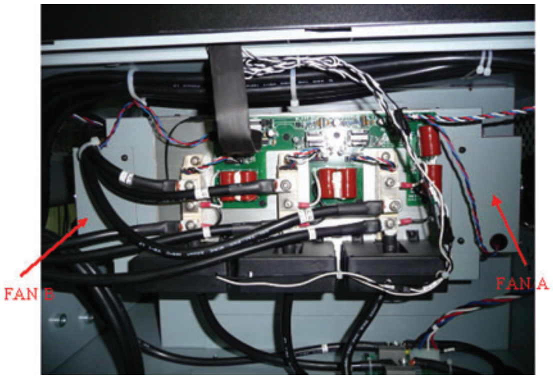


*Fig 5.2.12b*

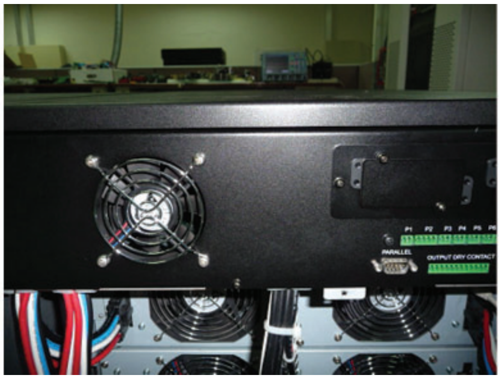

PARALLEL
OUTPUT DRY CONTACT

*Fig 5.2.12c*

## 5.2 Troubleshooting Flow Charts *(continued)*

### 5.2.13 "TRANSFORMER OVERHEAT"

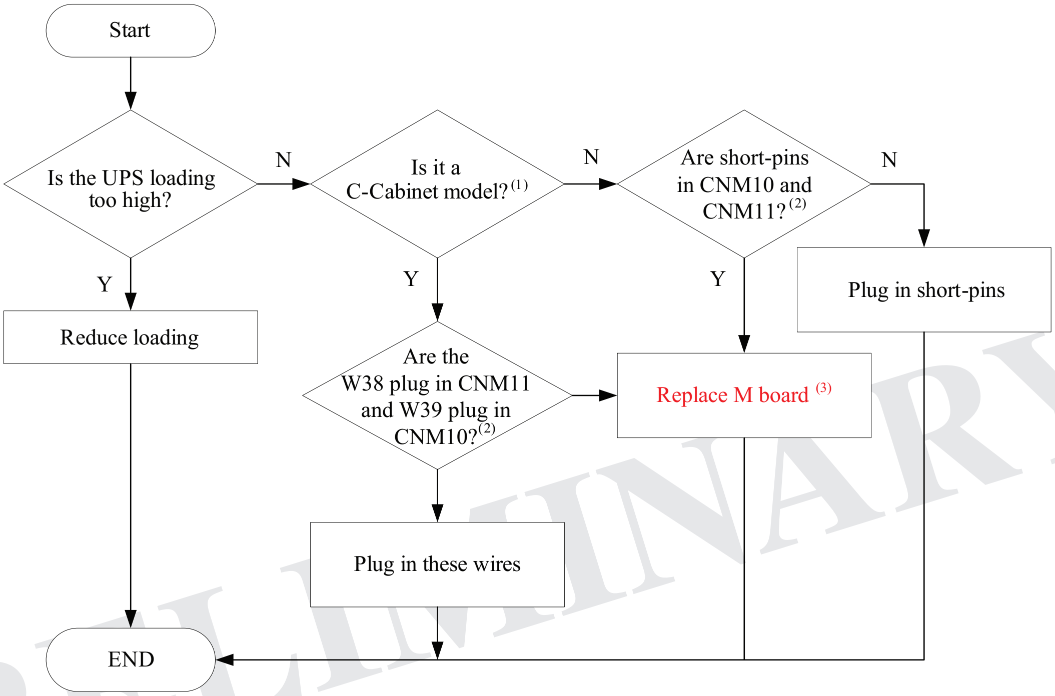

Start
Is the UPS loading too high?
N
Y
Reduce loading
Is it a C-Cabinet model? (1)
N
Y
Are the W38 plug in CNM11 and W39 plug in CNM10? (2)
Plug in these wires
Are short-pins in CNM10 and CNM11? (2)
N
Y
Plug in short-pins
Replace M board (3)
END

*Fig 5.2.13a*

***Note (1):*** *Models with C–cabinets are: SU40K, SU60K, SU80K, SU60KTV and SU80KTV.*

***Note (2):*** *See Figure 5.2.13b for location.*

***Note (3):*** *For the location of the NH-SYS-M board, turn to section 1.5. To replace the NHS-SYS-M board, remove the EEPROM chip from the old NHS-SYS-M board and insert it into the new one.*

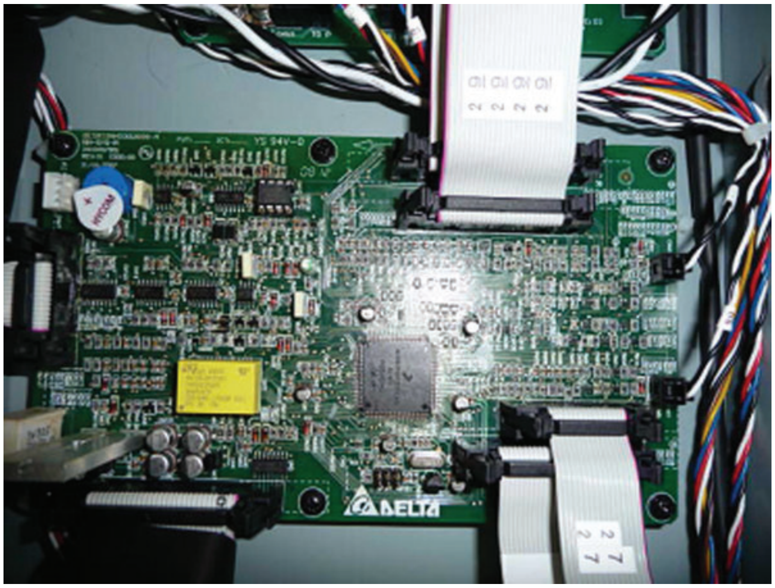


*Fig 5.2.13b*

### 5.2.14 “PS OUTPUT VOLT NOK”

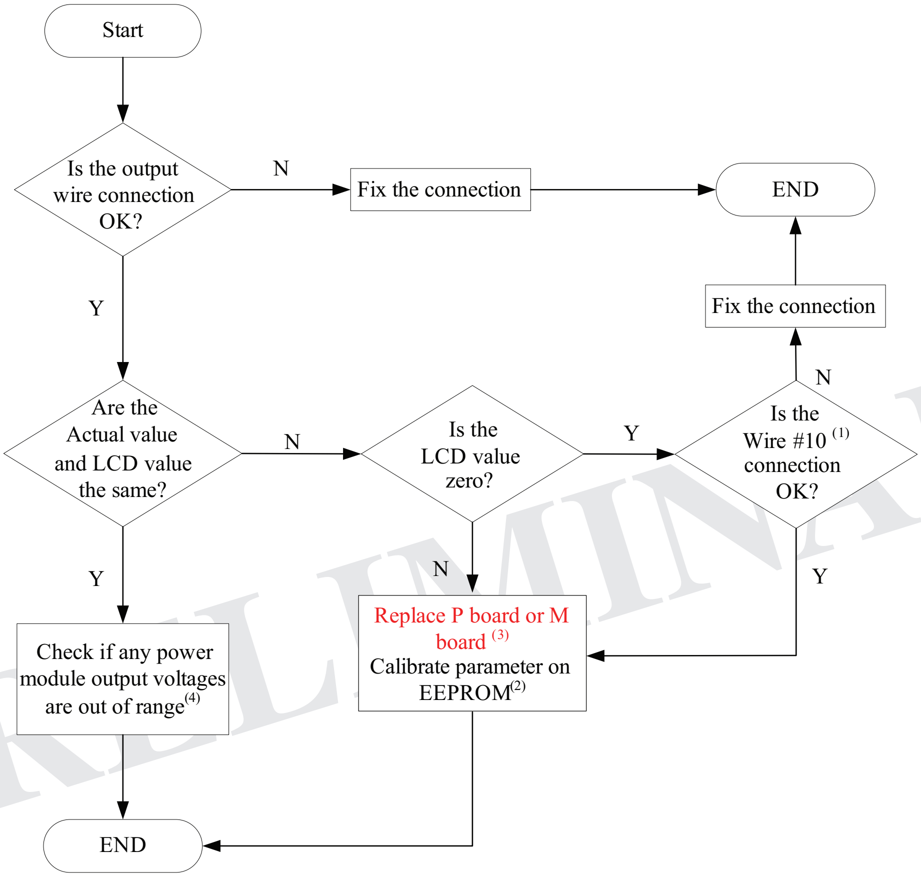

Start
Is the output wire connection OK?
N
Fix the connection
END
Y
Fix the connection
N
Are the Actual value and LCD value the same?
N
Is the LCD value zero?
Y
Is the Wire #10 (1) connection OK?
Y
N
Y
Check if any power module output voltages are out of range(4)
Replace P board or M board (3)
Calibrate parameter on EEPROM(2)
END

*Fig 5.2.14a*

***Note (1):*** *Wire #10 connects CNP9 on the NH-SYS-P board with CNFC20 on the NH-SYS-FC board (Figure 5.2.14b).*

***Note (2):*** *To learn about EEPROM parameter setting and calibration, refer to section 3.2.*

***Note (3):*** *For the location of the NH-SYS-P board and NH-SYS-M boards, turn to section 1.5. To replace the NHS-SYS-M board, remove the EEPROM chip from the old NHS-SYS-M board and insert it into the new one.*

***Note (4):*** *Check the output voltage of each power module one at a time. If normal, check the next power module.*

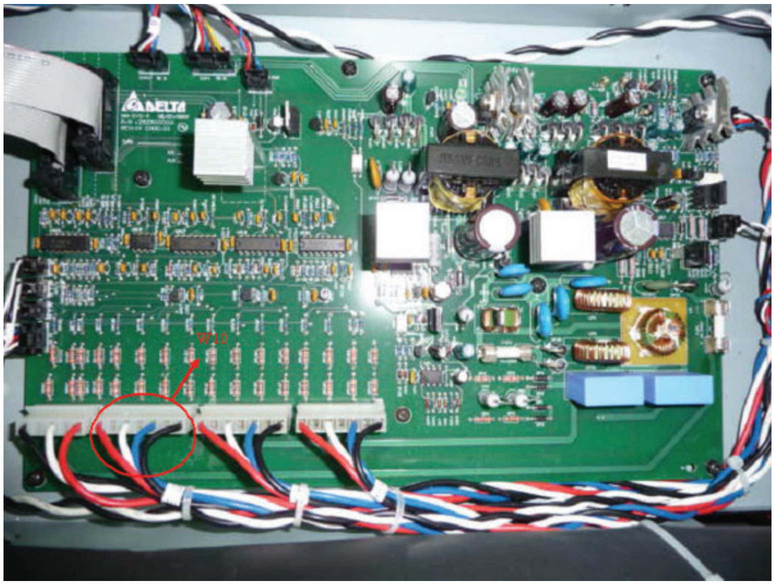


*Fig 5.2.14b*

## 5.2 Troubleshooting Flow Charts *(continued)*

### 5.2.15 "PS EXT PARALLEL COMM ABNORMAL"

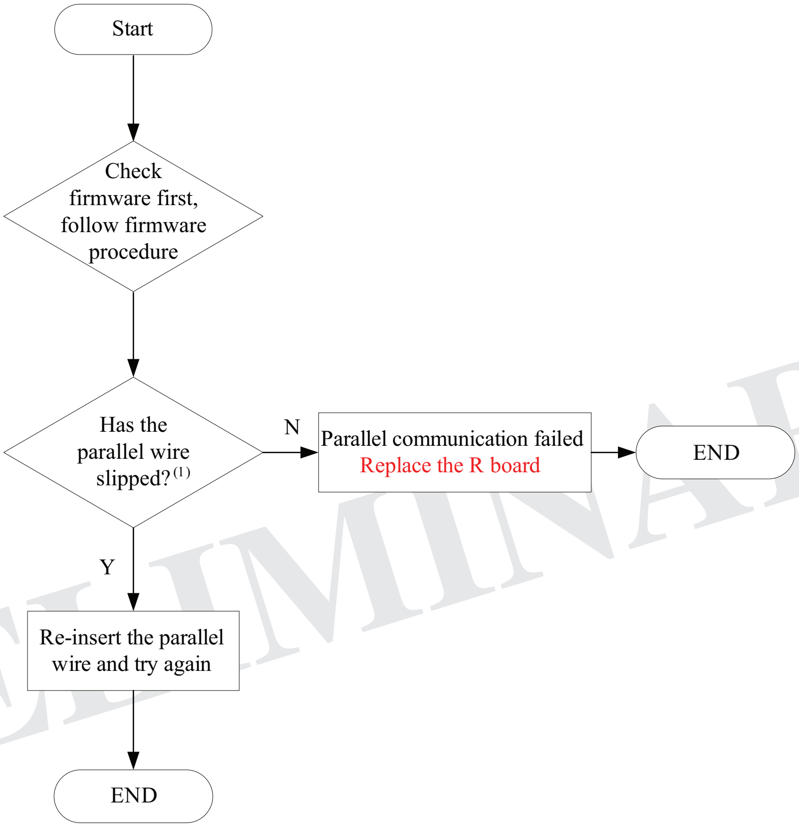

Start
Check firmware first, follow firmware procedure
Has the parallel wire slipped?(1)
N
Parallel communication failed
Replace the R board
END
Y
Re-insert the parallel wire and try again
END

*Fig 5.2.15a*

***Note (1):*** *The external parallel wire is located on the rear panel (Figure 5.2.15b).*

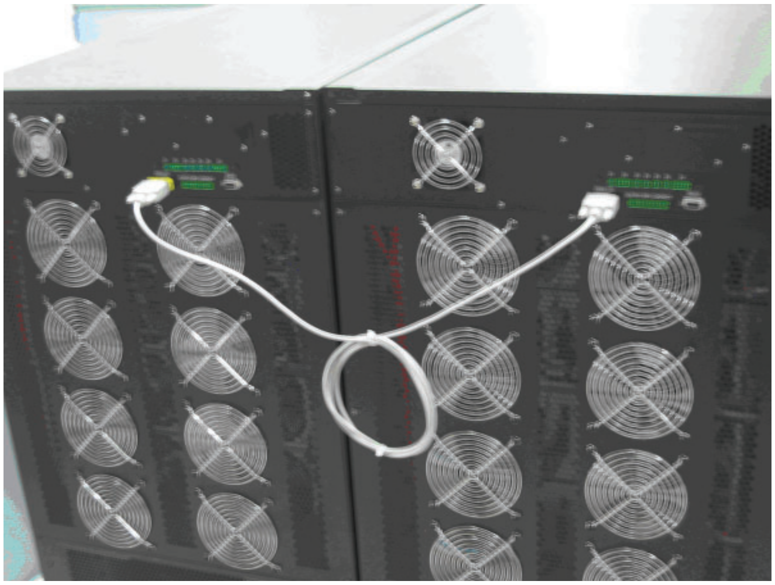


*Fig 5.2.15b*

## 5.2 Troubleshooting Flow Charts *(continued)*

### 5.2.16 "PARALLEL FAILURE"

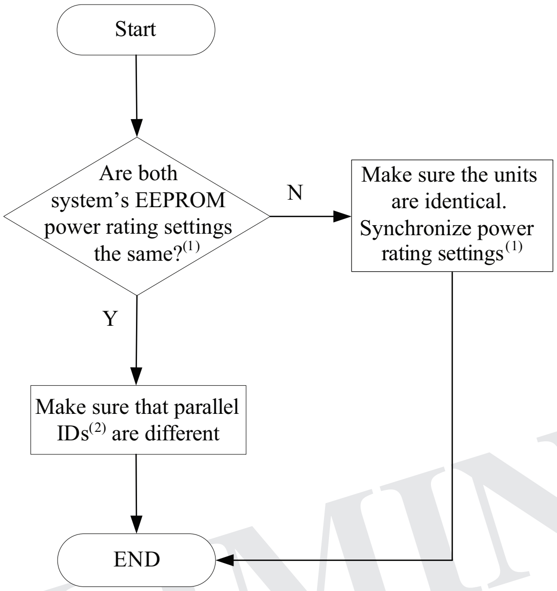
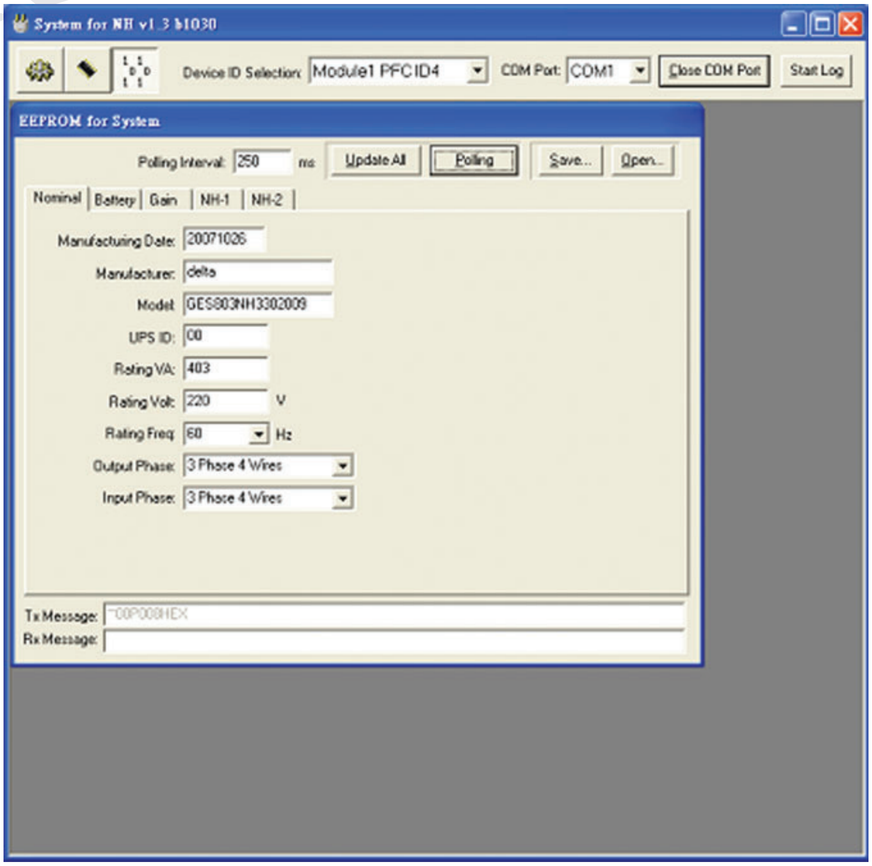

Start
Are both system's EEPROM power rating settings the same?(1)
N
Make sure the units are identical. Synchronize power rating settings(1)
Y
Make sure that parallel IDs(2) are different
END

*Fig 5.2.16a*

***Note (1):*** *Figure 5.2.16b shows the EEPROM's power rating settings (Rating VA). To learn about EEPROM parameter settings, turn to section 3.2.*

***Note (2):*** *Access parallel ID settings using the LCD control panel (bypass mode only).* (UPS SETUP ⟶ LOCAL SETUP ⟶ PARALLEL ID)


System for NH v1.3 b1030
Close COM Port
Start Log
EEPROM for System
Update All
Polling
Save...
Open...
Nominal
Battery
Gain
NH-1
NH-2

Device ID Selection: Module1 PFC ID4
COM Port: COM1
Polling Interval: 250 ms
Manufacturing Date: 20071026
Manufacturer: delta
Model: GES803NH3302009
UPS ID: 00
Rating VA: 403
Rating Volt: 220 V
Rating Freq: 60 Hz
Output Phase: 3 Phase 4 Wires
Input Phase: 3 Phase 4 Wires
Tx Message: ~00P008HEX
Rx Message:

*Fig 5.2.16b*

## 5.2 Troubleshooting Flow Charts *(continued)*

### 5.2.17 “REDUNDANCY LOSS”

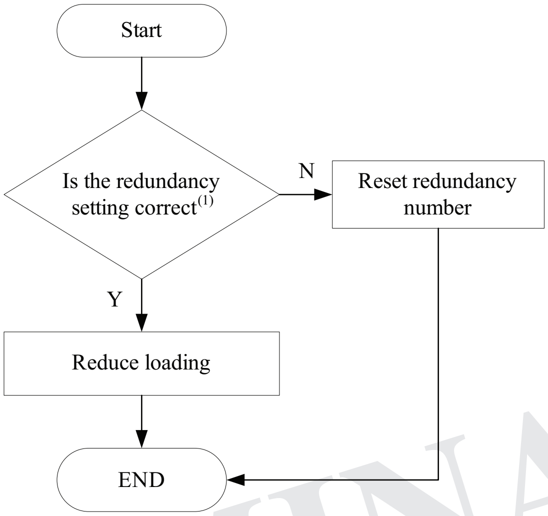

Start
Is the redundancy setting correct(1)
N
Reset redundancy number
Y
Reduce loading
END

*Fig 5.2.17a*

***Note (1):*** *Access the redundancy setting using the LCD control panel (only in bypass mode).* (UPS SETUP ⟶ REDUNDANCY SETUP)

Select the power module’s redundancy number.

EX: 40kVA UPS, load < 20kVA, redundancy number =1.
If one power module proves abnormal, another power module will continue to supply the load without interruption.

40kVA UPS, load > 20kVA, redundancy number =1.
LCD panel displays “REDUNDANCY LOSS” message.
If one power module is abnormal, another power module will be overloaded and shut down to bypass.

# 6 Power Module

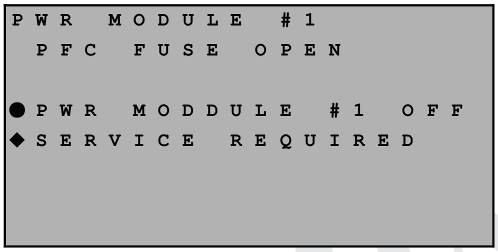
## 6.1 Failure Power Module Identify

**WARNING: Before opening the unit, please make sure that the UPS is in Manual Bypass mode so that it continues to supply power to the critical load (the critical load is supported directly by utility power).**

These instructions will help you diagnose which power modules have failed and which are protected.

1) Check the warning messages by pressing the "▼" or "▲" button on the main page of the control panel. (Figure 6.1a) (Table 5.1b lists the conditions for each power module warning message)

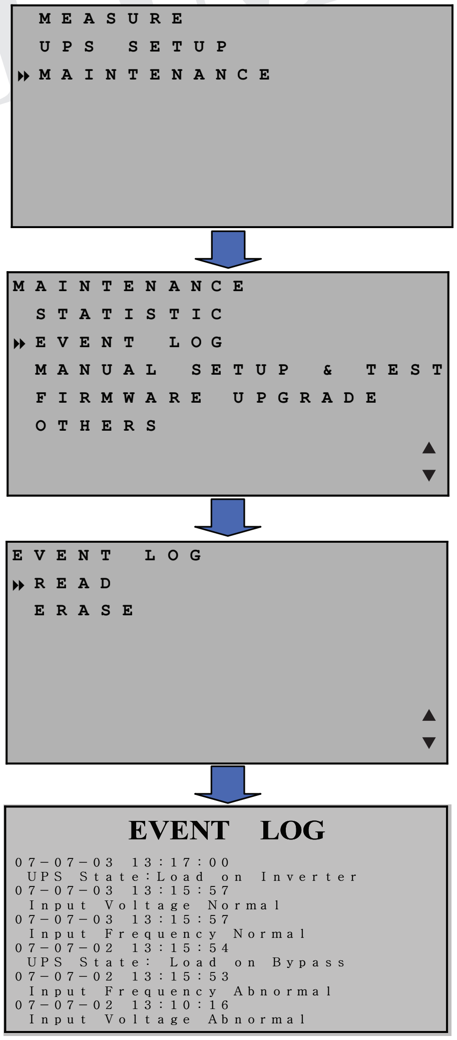
2) Check the event log message. (Figure 6.1b) (Maintenance ⟶ Event Log ⟶ Read)



```
PWR MODULE #1
 PFC FUSE OPEN

● PWR MODDULE #1 OFF
◆ SERVICE REQUIRED
```

*Fig 6.1a*

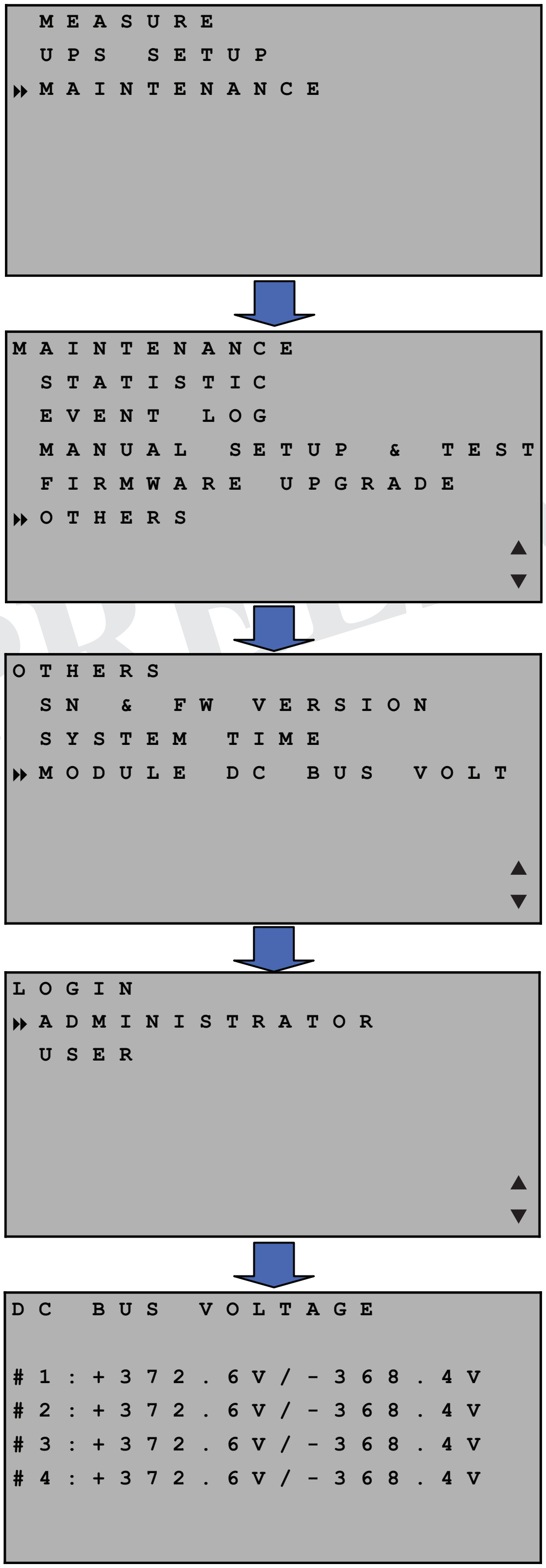

MEASURE
UPS SETUP
MAINTENANCE
MAINTENANCE
STATISTIC
EVENT LOG
MANUAL SETUP & TEST
FIRMWARE UPGRADE
OTHERS
EVENT LOG
READ
ERASE
EVENT LOG

```
07-07-03 13:17:00
 UPS State:Load on Inverter
07-07-03 13:15:57
 Input Voltage Normal
07-07-03 13:15:57
 Input Frequency Normal
07-07-02 13:15:54
 UPS State: Load on Bypass
07-07-02 13:15:53
 Input Frequency Abnormal
07-07-02 13:10:16
 Input Voltage Abnormal
```

*Fig 6.1b*

## 6.1 Failure Power Module Identify *(continued)*

3) Check the information of DC BUS voltage. (Figure 6.1c) (Maintenance ⟶ Others ⟶ Module DC BUS volt ⟶ Administrator) Normally, the DC BUS voltage of a power module is about +/- 370Vdc. Use this number to confirm which power module is abnormal.
4) Check the Output of Power modules. (Figure 6.1d) (Measure ⟶ press "▼" or "▲" button to choose)



```
  MEASURE
  UPS SETUP
▸▸MAINTENANCE
```

```
MAINTENANCE
  STATISTIC
  EVENT LOG
  MANUAL SETUP & TEST
  FIRMWARE UPGRADE
▸▸OTHERS
                          ▲
                          ▼
```

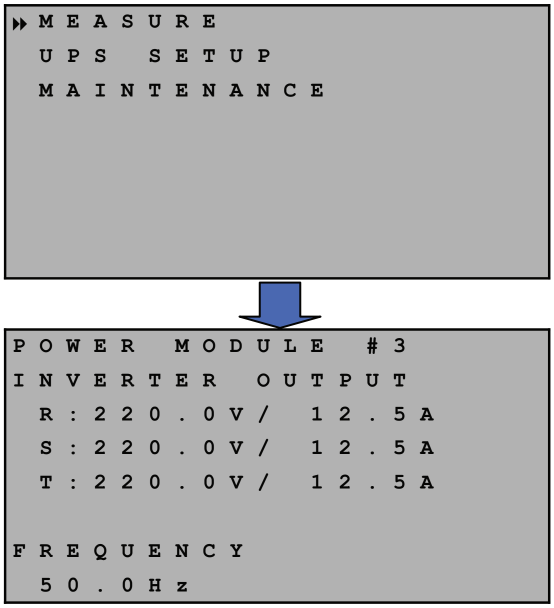
```
OTHERS
  SN & FW VERSION
  SYSTEM TIME
▸▸MODULE DC BUS VOLT
                          ▲
                          ▼
```

```
LOGIN
▸▸ADMINISTRATOR
  USER
                          ▲
                          ▼
```

```
DC BUS VOLTAGE

#1:+372.6V/-368.4V
#2:+372.6V/-368.4V
#3:+372.6V/-368.4V
#4:+372.6V/-368.4V
```

*Fig 6.1c*



```
▸▸MEASURE
  UPS SETUP
  MAINTENANCE
```

```
POWER MODULE #3
INVERTER OUTPUT
  R:220.0V/ 12.5A
  S:220.0V/ 12.5A
  T:220.0V/ 12.5A

FREQUENCY
  50.0Hz
```

*Fig 6.1d*

## 6.1 Failure Power Module Identify *(continued)*

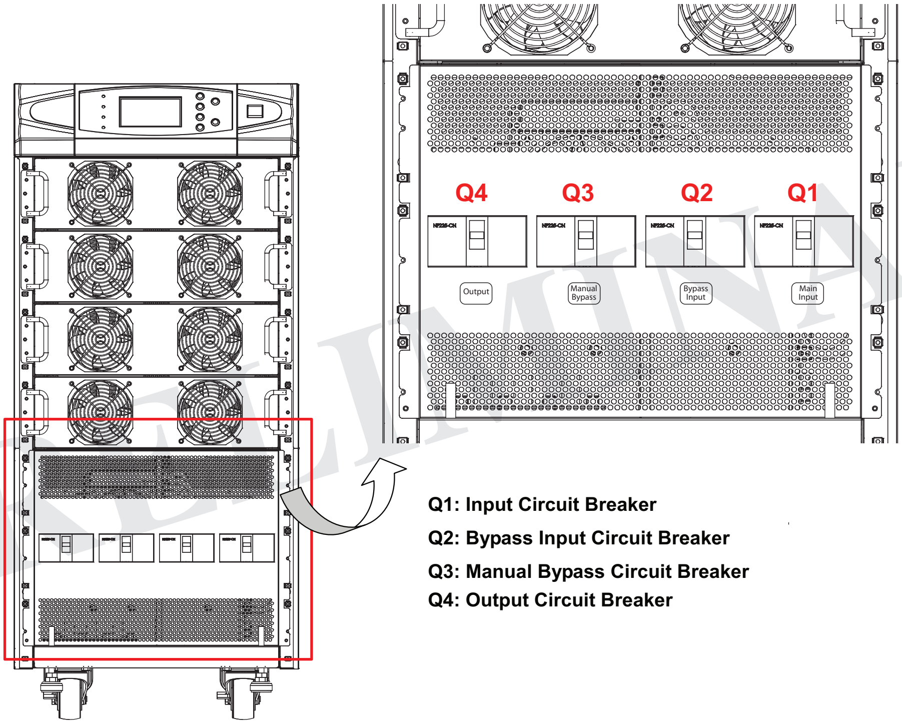
5) (Use this step to shut down the UPS with load protection)

Set UPS to manual bypass mode.

If the UPS is on normal mode, press the “OFF” button to enter bypass mode. Then turn on the manual bypass circuit breaker (Q3) and turn off the output circuit breaker (Q4). (Figure 6.1e)

Next, turn off the main input circuit breaker (Q1) so that the power module discharges its DC BUS voltage. Monitor the power module’s output (Figure 6.1d) and DC BUS voltage (Figure 6.1c) using the LCD panel.

These voltages will decrease gradually within each normal power module.



**Q1: Input Circuit Breaker**
**Q2: Bypass Input Circuit Breaker**
**Q3: Manual Bypass Circuit Breaker**
**Q4: Output Circuit Breaker**

*Fig 6.1e*

Ultimately, normal power modules will shut down (with fans inactive), while faulty power modules will still be pending (no discharge, fans still active).

Finally, turn off the battery switch to force the power modules to shut down. At this point, faulty power modules have either failed or are being protected.

6) Turn on the main input circuit breaker. Then, once the fan is active, turn off the main input circuit breaker. Normal power modules will shut down instantly, while faulty power module will discharge DC BUS voltage.

Failed power modules can be identified by the following:

- Inactive fans
- Alarm message on LCD

If neither of these occur, follow step 7 to ascertain that the faulty power modules are protected.

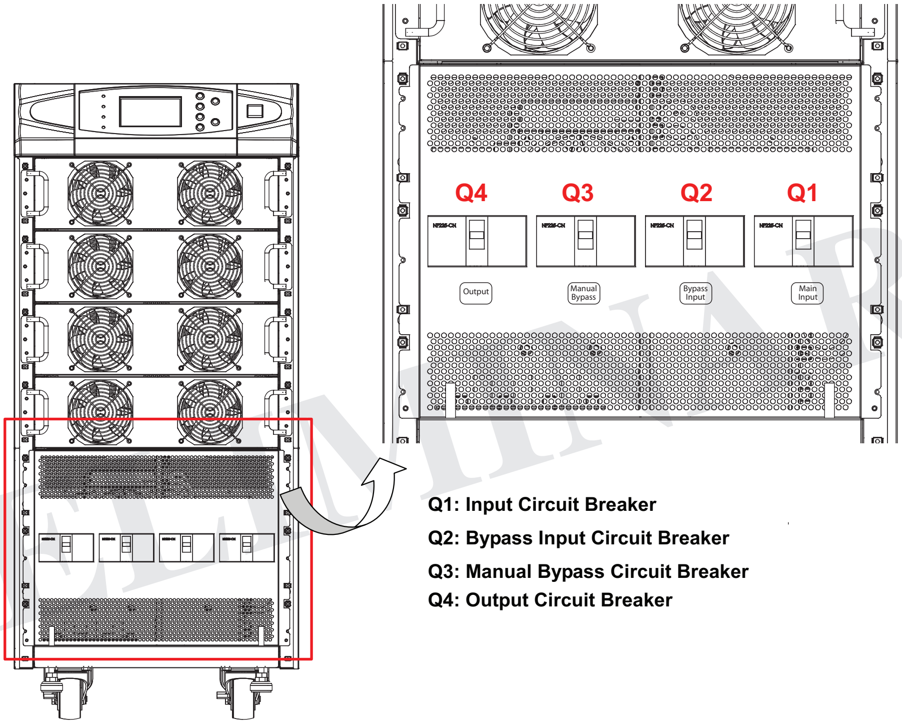
7) Turn on the main input circuit breaker and observe whether the power module’s DC BUS voltage (Figure 6.1c) ever reaches +/- 370Vdc. If it does not, or you receive an alarm message, the power module has failed.

Turn off the main input circuit breaker and monitor the output message for each power module (Figure 6.1d). If the output voltage is abnormal or you receive an alarm message, the power module has failed.

## 6.2 Power Module Replacement

**WARNING: Before opening the unit, please make sure that the UPS is in** Manual Bypass **mode so that it continues to supply power to the critical load (the critical load is supported directly by utility power).**

**WARNING: Make sure that the UPS unit is shut down completely. (Main Input circuit breaker (Q1), Bypass Input circuit breaker (Q2) and Output circuit breaker (Q4) must be OFF (see Figure 6.2a).)**



**Q1: Input Circuit Breaker**
**Q2: Bypass Input Circuit Breaker**
**Q3: Manual Bypass Circuit Breaker**
**Q4: Output Circuit Breaker**

*Fig 6.2a*

To remove the power module:

a) Unscrew the rear panel cover (Figure 6.2b).

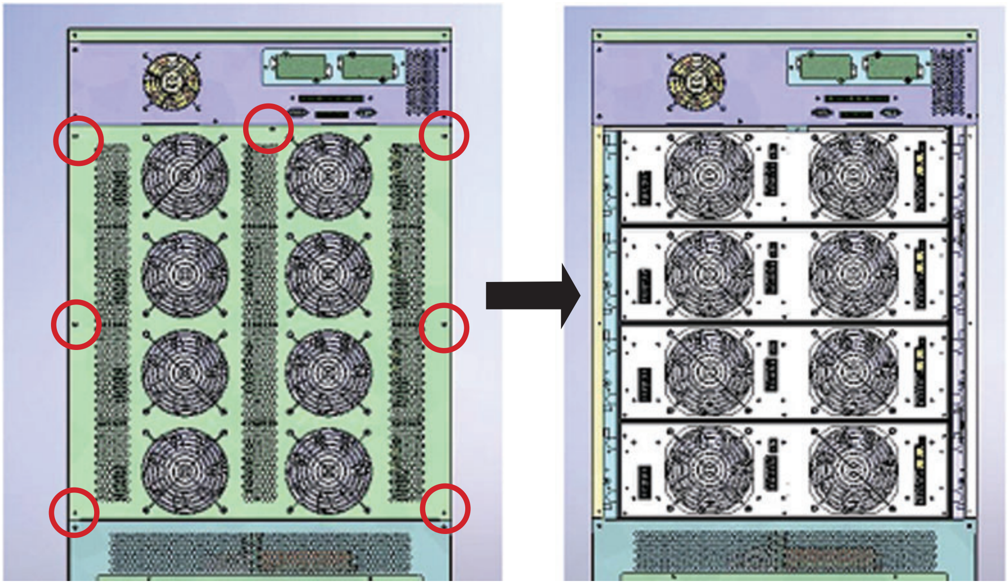


*Fig 6.2b*

## 6.2 Power Module Replacement *(continued)*

b) Disconnect the power module (Figures 6.2c and 6.2d).

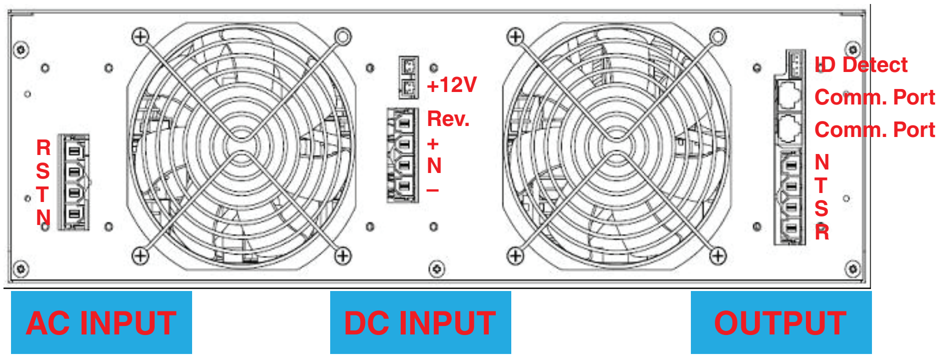

R
S
T
N
+12V
Rev.
+
N
−
ID Detect
Comm. Port
Comm. Port
N
T
S
R
AC INPUT
DC INPUT
OUTPUT

*Fig 6.2c*

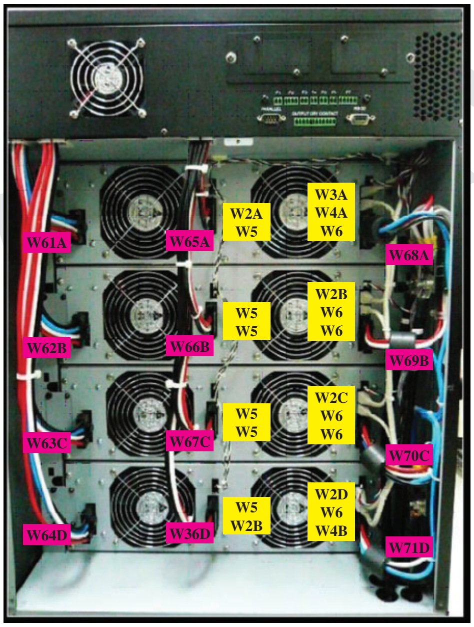

W3A
W4A
W6
W2A
W5
W61A
W65A
W68A
W2B
W6
W6
W5
W5
W62B
W66B
W69B
W2C
W6
W6
W5
W5
W63C
W67C
W70C
W2D
W6
W4B
W5
W2B
W64D
W36D
W71D

*Fig 6.2d*

## 6.2 Power Module Replacement *(continued)*

c) Unscrew the rear panel of the power module (Figure 6.2e).

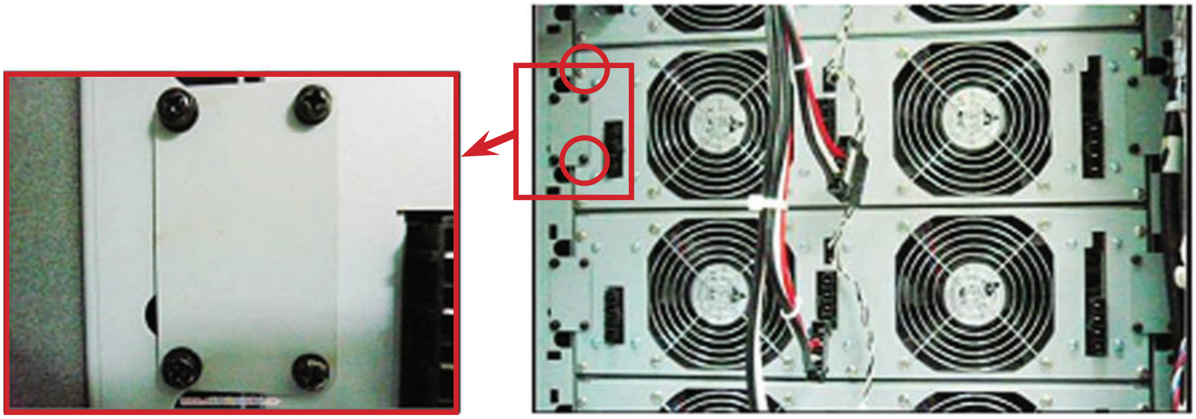


*Fig 6.2e*

d) Remove the corner bezels of the power module from the front side (Figure 6.2f).

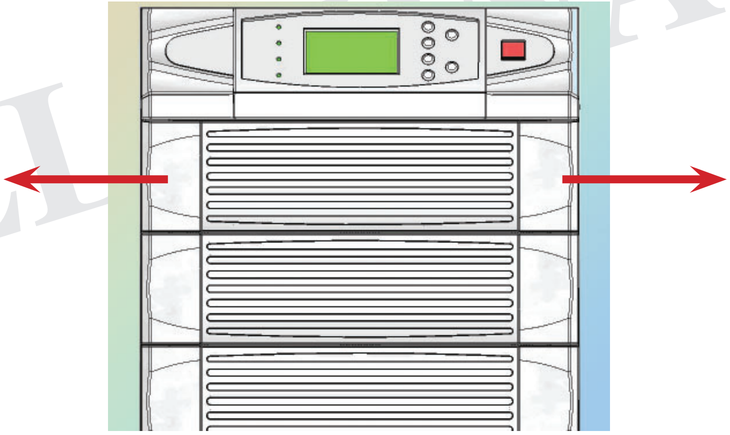


*Fig 6.2f*

e) Unscrew the front bezel (Figure 6.2g).

f) Remove the front bezel.

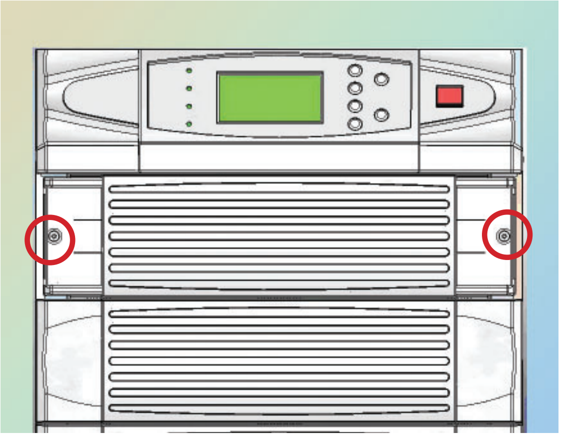


*Fig 6.2g*

## 6.2 Power Module Replacement *(continued)*

g) Unscrew the front of the power module (Figure 6.2h).

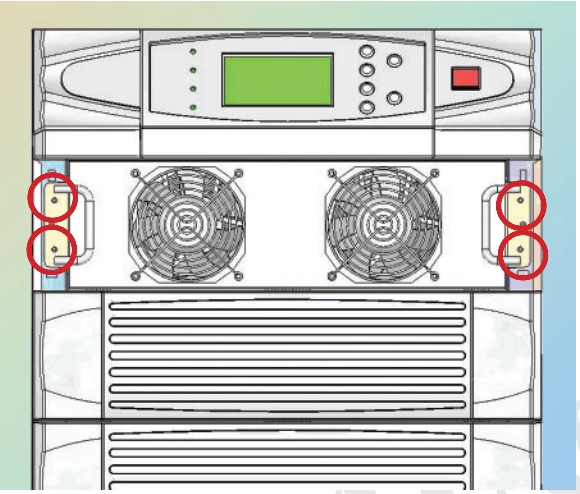


*Fig 6.2h*

h) Remove the power module (Figure 6.2i).

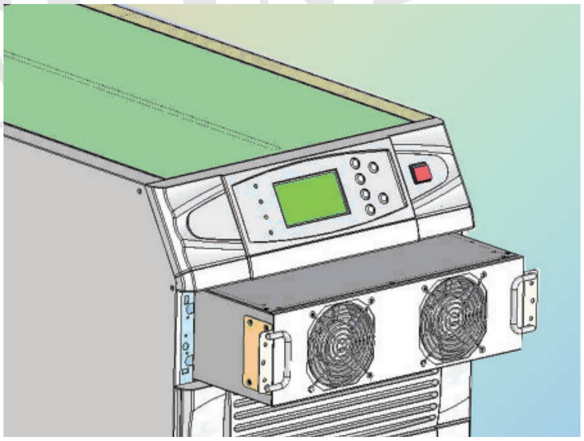


*Fig 6.2i*

# 7 Preventive Maintenance

## 7.1 Safety Overview

Hazardous voltages and currents are present in this equipment! Hazardous energy is stored and will still be present even when the equipment is turned off and removed from power mains!

Personal protective equipment is required when working on this equipment. This includes safety glasses, insulated gloves, and insulating blankets to prevent shorts or accidental contact with live circuits.

LOTO (Lockout-Tagout) procedures should be used when service cannot be completed in one visit.

Insulated tools are required for service inside power modules or battery cabinets when working hot.

Use a voltmeter to verify that voltage has been removed before servicing any module.

Use a voltmeter to determine that voltages and polarities are correct before re-connecting any batteries or battery cabinets.

If you are working with someone else, be certain that you know what the other person is doing at all times AND that the other person knows what you are doing!

## 7.2 Suggested tools and supplies

- Insulated tools:
  Torque wrench
  Socket set, ratchet
  Screwdrivers (Philips and common)
  Magnetic Philips screw driver
  Needle-nose pliers
  Diagonal wire cutters
- Oscilloscope—199 Fluke Scope meter or equivalent
- Digital Multi-meter—189 Fluke or equivalent true RMS with diode scale
- Clamp-on Ammeter—AC/DC; true RMS
- Non-contact infra-red thermometer
- TIF tester (for battery module)
- Small soldering iron and rosin-core solder
- Insulated gloves
- ESD protective equipment (grounded pad, wrist strap)
- Insulating blanket
- Electrical tape
- Heat sink thermal compound
- Plastic ties

## 7.3 UPS Procedure

### 7.3.1

Check the LCD display and the LED panel for status and alarms. If the unit is operating normally and no alarms are present, or if the unit has an active alarm, download the event log and failure power module identify (Please refer to chapter 3 and chapter 6 of “owner’s manual”).

### 7.3.2

Remove the rear, side, top and front covers. Perform an infrared scan on input and bypass breakers, cables and wire connections (terminal blocks, internal connect, etc.), and other assemblies. What are we looking for? What temperature limits can not be exceeded?

### 7.3.3

Visually inspect cables for signs of overheated or damaged insulation. Visually inspect modules for damage and inspect bypass STS snubbers for damage.

### 7.3.4

Measure Ø to Ø and Ø to Neutral main input voltage, bypass input voltage and enter those on the form. Note that phases R, S, T correspond to A, B, C on the form. Compare the meter readings with the LCD display readings. If the voltage readings are correct within +/- 1%, check input metering OK on the form. If there is a greater discrepancy, enter that in NOTES. Then what do we do? Is there a troubleshooting tree to reference in the service manual?

## 7.3 UPS Procedure *(continued)*

**7.3.5**

Measure Ø to Ø and Ø to Neutral output voltage and output current as above and enter the values on the form. Compare the readings to the LCD display. If the voltage readings are within +/- 1% and the current readings are within +/- 1 ampere, check output metering OK on the form. If there is a greater discrepancy, enter that in NOTES. Then what do we do? Is there a troubleshooting tree to reference in the service manual?

**7.3.6**

Check DC BUS voltage from the LCD display and enter those voltages on the form. DC bus voltages should be 370V within +/- 3V. If there is a greater difference, enter that in NOTES. Then what do we do? Is there a troubleshooting tree to reference in the service manual?

**7.3.7**

Use a digital multi-meter to measure battery DC voltage at the terminal blocks and enter that information on the battery PM form. Use a clamp-on ammeter to measure DC charge current and enter that information on the battery PM form. What should the current be? Is there an expected limit not to be under or exceed?

**7.3.8**

Perform the visual battery inspection. Note any problems. Then take an infrared reading of ambient temperature and the inside of the battery compartment and enter that information on the form. Note on the form if battery temperature exceeds 95O F, or 32O F above ambient. What steps should be followed to address this issue? Is this an information only step?

**7.3.9**

If the battery PM is to be performed, it should be done at this time. See section 7.4 for the internal battery procedure.

**7.3.10**

When inspection is complete, replace the rear, side, top and front covers of the UPS.

**7.3.11**

When you turn on manual bypass under the following situation :

1. Replace the failure power module with a new one.
2. Replace the failure board/components in the system

Please follow the regular turn-on procedure. Turn on the bypass input, output and main input breaker. Verify the static switch is load on the bypass, turn off the manual bypass breaker.

**7.3.12**

Check the LCD display to verify DC BUS voltages are present, and then press the "ON" key. Verify that the inverter starts and operates correctly per the LED panel and LCD display.

**7.3.13**

Summarize the results of the inspection with the customer representative on site. Be sure to note any items that will require service or customer action.

## 7.4 Internal Battery Procedure

Battery module PM inspection should always be performed at a time approved by the customer since the Battery Module must be disconnected and critical loads will not be backed up.

Because the SU series UPS units are direct coupled, all terminals of the battery circuit have hazardous voltage with respect to ground when the battery is connected.

Always remove fuses and disconnect the Anderson connectors before working on any part of the battery module. However, hazardous voltages will still exist between battery terminals.

Always insulate the exposed ends of any cables that must be disconnected, using electrical tape. Secure loose cables so that they cannot come in contact with other cables, surfaces, or connections.

When any cable or connector is disconnected, always use a voltmeter to verify that zero voltage exists before reconnecting.

a) While the inverter is normal, press OFF switch, turn off the Main circuit breaker Switch, turn on the Manual Bypass switch, and turn off the Bypass circuit breaker Switch. Perform the visual battery inspection. Note any problems. Then take an infrared reading of ambient temperature and the inside of the battery compartment and enter that information on the form. Note on the form if battery temperature exceeds 84O F, or 10O F above ambient What action should be taken if this condtion is present? Where do we go to in the manual?

b) Remove the battery compartment panels, and disconnect the Anderson connectors.

NOTE: Hazardous voltage exists between the fuse clips even after the battery cable is disconnected, as well as between all electrical connections in the battery module!

## 7.4 Internal Battery Procedure

c) Use the infrared thermometer to measure the ambient temperature near the battery module and the internal temperature of the battery module. Note that the best place to read ambient temperature is on the floor immediately behind the battery module. Battery module internal temperature should be taken at one of the jars on a top tier.

d) Use the digital multi-meter to read the voltage across each tray. Note if the voltage is outside the range 130V to 138V for any tray.

e) Replace the tray and re-connect the Anderson connectors.

f) Repeat steps d) through e) for the remaining battery trays.

g) When the battery cabinet inspection is complete, replace the cover. Turn on the Main input circuit breaker and Bypass input breaker on the UPS. When the static switch is operating, turn off the Manual Bypass switch

h) Verify using the LCD display that the main input and DC bus voltages are correct, then press the ON switch. Verify that the inverter starts and operates correctly per the LED panel and LCD display.

# Appendix A Service Equipment and Tools

## Recommended Equipment and Tools

- **Laptop:** with series COM port
- **Multi-Meter**
- **Oscilloscope**
- **Clamp Meter:** for measurement of current
- **Screwdriver:** Phillips-head and slotted
- **Hex Wrench:** 5mm and 6mm
- **Socket Wrench:** 13mm and 17mm
- **Diagonal Cutters**

## Software Tools

- ***NH_SYS_V1_3B1030.exe:*** For system EEPROM parameter settings and calibration.
- ***FSL 3.75.exe:*** For upgrading the system MCU’s firmware on a NH-SYS-M board.
- ***NH_PM_V1_4B1207.exe:*** For upgrading the power module’s firmware.
- ***NH-Dry-Contact v1.0b1024.exe:*** For output dry contact status setting.
- ***NH-EventLog v1.0b1115.exe:*** For downloading the UPS event log.

# Appendix B Torque Table

## KX Models

Tables B.1 and B.2 list the torque for terminal block connection. (For TB locations, see Figure B.a.)

**Table B.1**

| SU20KX | | |
|---|---|---|
| | Torque lb-in (kgf-cm) | Screwdriver |
| Input TB | 15.6 (18) | Slotted Screwdriver |
| Bypass TB | 15.6 (18) | Slotted Screwdriver |
| Battery TB | 15.6 (18) | Slotted Screwdriver |
| OUTPUT TB | 15.6 (18) | Slotted Screwdriver |
| Ground | 130.2 (150) | 13mm Socket Wrench |
| **SU40KX** | | |
| Input TB | 30.4 (35) | Slotted Screwdriver |
| Bypass TB | 30.4 (35) | Slotted Screwdriver |
| Battery TB | 30.4 (35) | Slotted Screwdriver |
| OUTPUT TB | 30.4 (35) | Slotted Screwdriver |
| Ground | 130.2 (150) | 13mm Socket Wrench |

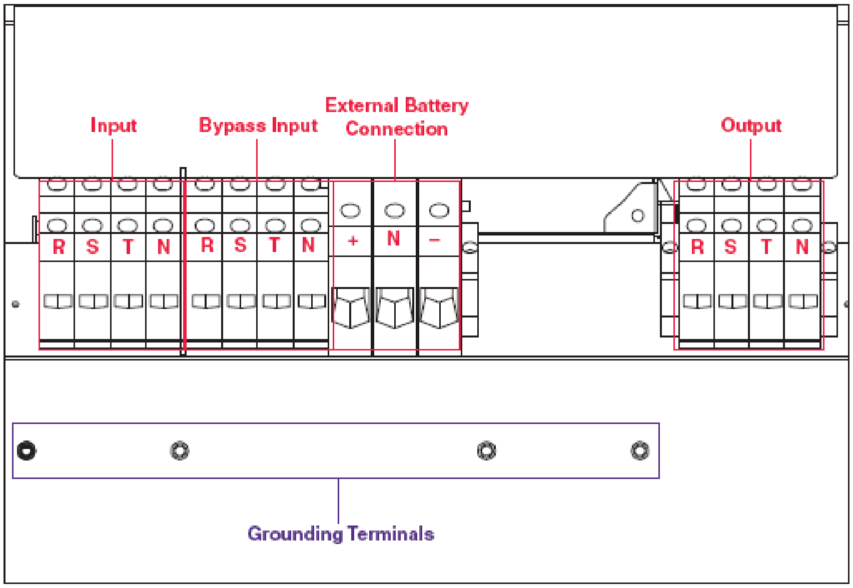

Input
Bypass Input
External Battery Connection
Output
R
S
T
N
R
S
T
N
+
N
–
R
S
T
N
Grounding Terminals

*Fig B.a.*

## KX Models *(continued)*

**Table B.2**

| **SU60KX** | | |
|---|---|---|
| | Torque lb-in (kgf-cm) | Screwdriver |
| Input TB | 50 (57.6) | Slotted Screwdriver |
| Bypass TB | 50 (57.6) | Slotted Screwdriver |
| Battery TB | 50 (57.6) | Slotted Screwdriver |
| OUTPUT TB | 50 (57.6) | Slotted Screwdriver |
| Ground | 130.2 (150) | 13mm Socket Wrench |
| **SU80KX** | | |
| Input TB | 50 (57.6) | Slotted Screwdriver |
| Bypass TB | 50 (57.6) | Slotted Screwdriver |
| Battery TB | 50 (57.6) | 5mm Hex Wrench |
| OUTPUT TB | 50 (57.6) | Slotted Screwdriver |
| Ground | 130.2 (150) | 13mm Socket Wrench |

## K Models

Table B.3 lists the torque for terminal block connection. (For SU40K and SU60K TB locations, see Figure B.b.) (For SU80K TB locations, see Figure B.c.)

**Table B.3**

| **SU40K** | | |
|---|---|---|
| | Torque lb-in (kgf-cm) | Screwdriver |
| Input TB | 50 (57.6) | 5mm Hex Wrench |
| Battery TB | 50 (57.6) | Slotted Screwdriver |
| OUTPUT TB | 50 (57.6) | 5mm Hex Wrench |
| Ground | 217 (250) | 17mm Socket Wrench |
| **SU60K** | | |
| Input TB | 90 (130.7) | 6mm Hex Wrench |
| Battery TB | 50 (57.6) | Slotted Screwdriver |
| OUTPUT TB | 90 (130.7) | 6mm Hex Wrench |
| Ground | 217 (250) | 17mm Socket Wrench |
| **SU80K** | | |
| Input Bar | 217 (250) | 17mm Open End Wrench & Socket Wrench |
| Battery TB | 50 (57.6) | 5mm Hex Wrench |
| OUTPUT Bar | 217 (250) | 17mm Open End Wrench & Socket Wrench |
| Ground | 217 (250) | 17mm Socket Wrench |

## K Models

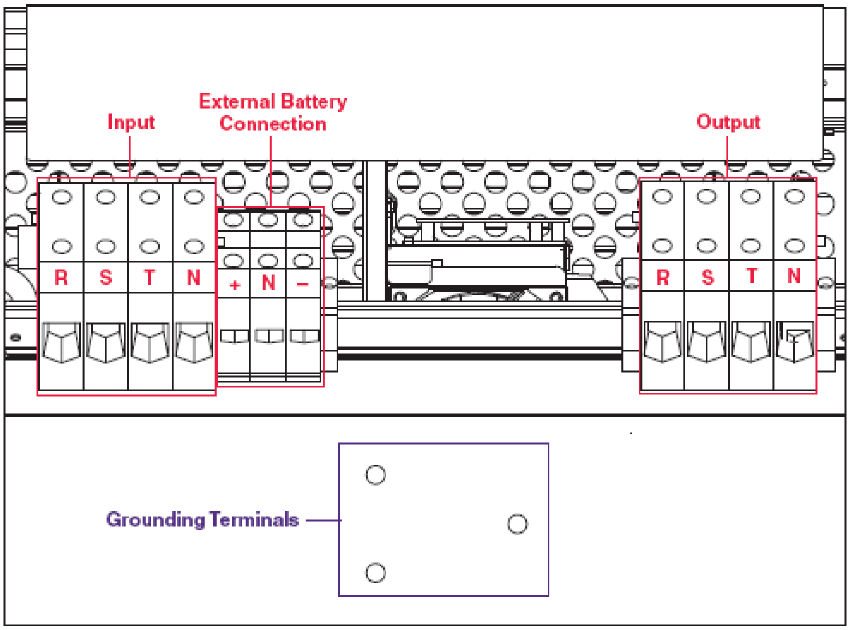

External Battery Connection
Input
Output
R
S
T
N
+
N
–
R
S
T
N
Grounding Terminals

*Fig B.b.*

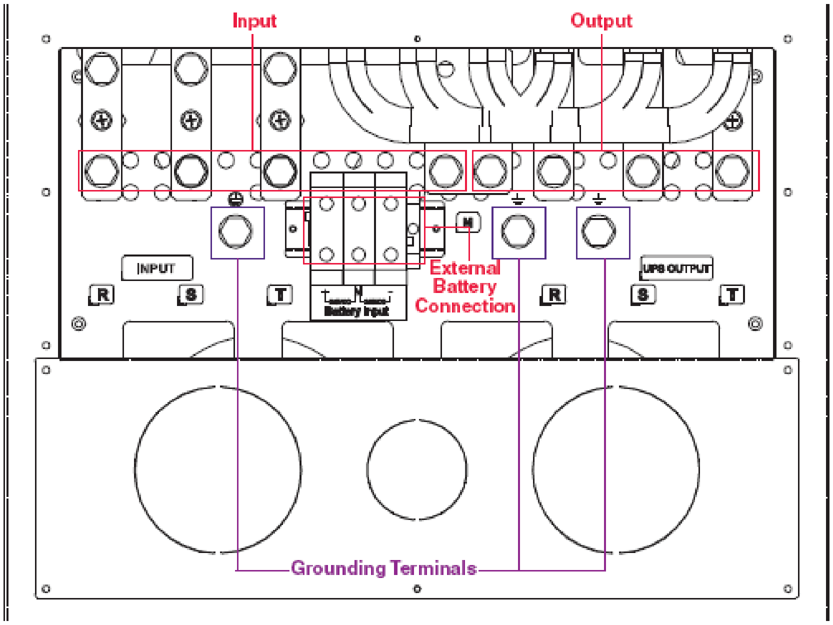

Input
Output
INPUT
R
S
T
External Battery Connection
Battery Input
UPS OUTPUT
R
S
T
Grounding Terminals

*Fig B.c.*

## KTV Models

Table B.4 lists the torque for terminal block connection. (For TB locations, see Figure B.d.)

**Table B.4**

| SU60KTV | | |
|---|---|---|
| | Torque lb-in (kgf-cm) | Screwdriver |
| Input TB | 50 (57.6) | Slotted Screwdriver |
| Battery TB | 50 (57.6) | Slotted Screwdriver |
| OUTPUT TB | 50 (57.6) | Slotted Screwdriver |
| Ground | 217 (250) | 17mm Socket Wrench |
| **SU80KTV** | | |
| Input TB | 50 (57.6) | 5mm Hex Wrench |
| Battery TB | 50 (57.6) | 5mm Hex Wrench |
| OUTPUT TB | 50 (57.6) | 5mm Hex Wrench |
| Ground | 217 (250) | 17mm Socket Wrench |

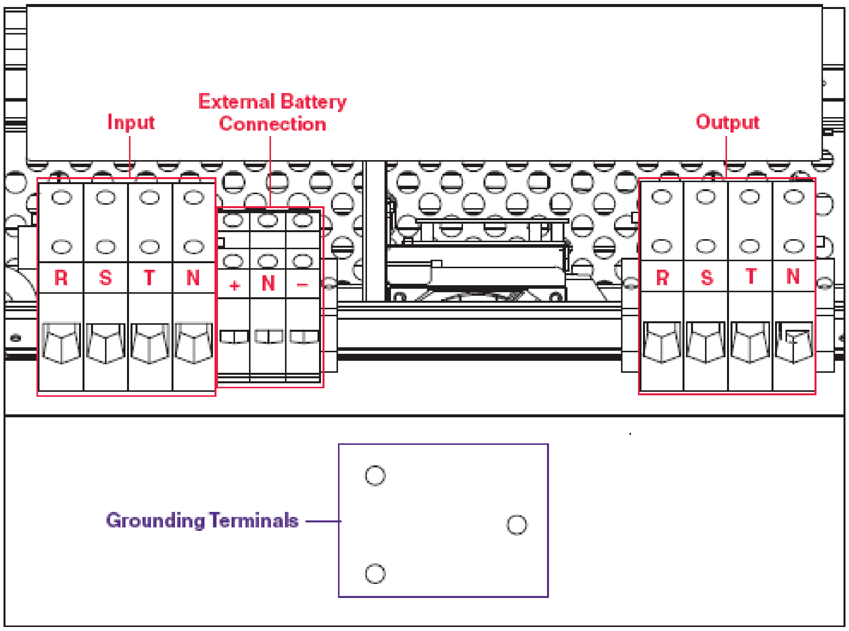

Input
External Battery Connection
Output
R
S
T
N
+
N
–
R
S
T
N
Grounding Terminals

*Fig B.d.*

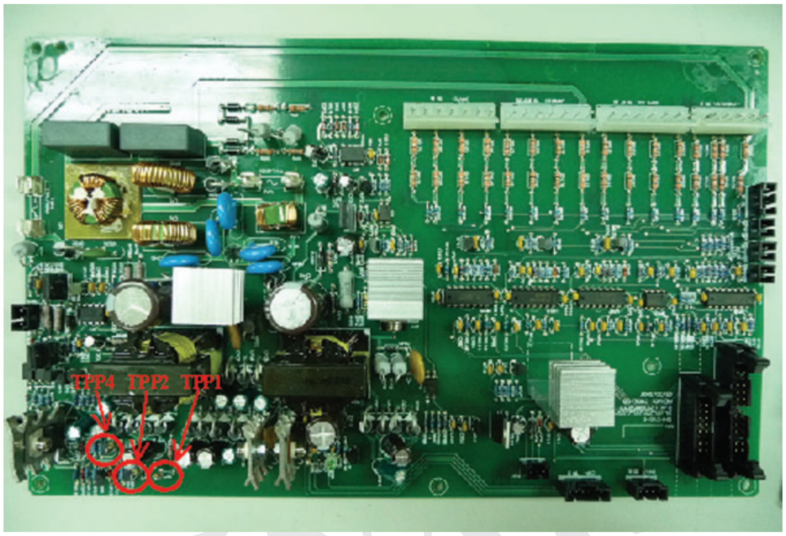
# Appendix C PCB and Test Point

## NH-SYS-P Board

TPP1: Reference ground (GND) of control circuit power

TPP2: +12V of control circuit power

TPP4: -12V of control circuit power



## NH-SYS-R Board

TPR1: Reference ground (GND) of control circuit power

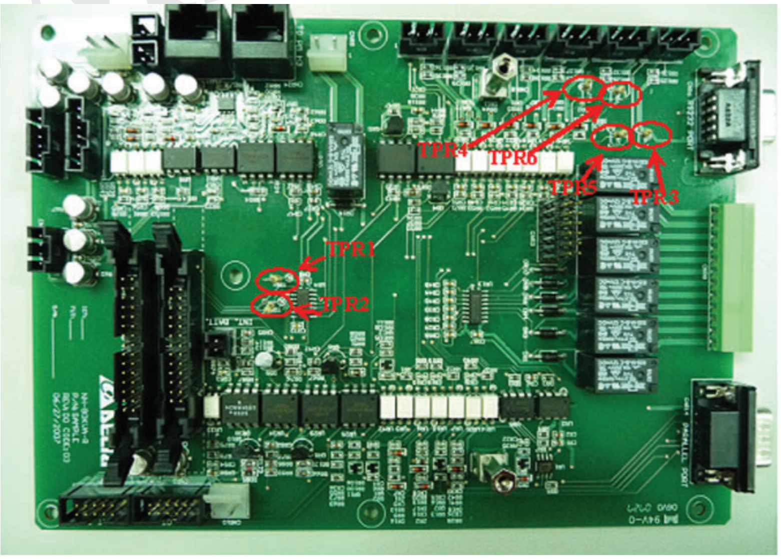
TPR2: Synchronous signal

TPR3: Reference ground (GND) of communication circuit power

TPR4: +5V of communication circuit power

TPR5: +12V of communication circuit power

TPR6: -12V of communication circuit power



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